DOCUMENT RESUME

ED 418 689 IR 018 784

AUTHOR	Sherman, Lee, Ed.
TITLE	Taking Off: A Teacher's Guide to Technology.
INSTITUTION	Northwest Regional Educational Lab., Portland, OR.
SPONS AGENCY	Department of Education, Washington, DC.
PUB DATE	1998-00-00
NOTE	49p.; Available electronically: http://www.nwrel.org
CONTRACT	RJ96006501
PUB TYPE	Collected Works - Serials (022)
JOURNAL CIT	Northwest Education; v3 n3 Spr 1998
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	*Class Activities; *Computer Assisted Instruction; Educational Technology; Elementary Secondary Education; *Instructional Innovation; Internet; Learning Activities; Student Projects; *Teacher Role; Teaching Guides; Teaching Methods; Training
IDENTIFIERS	*Technology Integration; *United States (Northwest)

ABSTRACT

This theme issue of the serial "Northwest Education" focuses on how teachers are using technology in diverse subjects, in addition to addressing the role of teachers in an environment of continuous change brought on by technological developments. The first article, "The Promise of Technology," argues that if technology is to become an agent for change in the nation's classrooms, teachers must get the training and support they need; this ongoing assistance requires that money and time be allocated toward teacher development. A Special Report, "Flying High," offers a glimpse inside classrooms around the U.S. Northwest where teachers are using technology skillfully to teach subjects as diverse as economics and ecology. Projects and methods are described for schools in ten Northwestern cities; each profile offers teacher footnotes on various items, including technology used, project implementation, teacher role, and costs. "Conquering the Computer" offers practical tips for using the Internet and selecting software, and a longtime teacher shares her strategies for getting the most from a single computer in a classroom full of children in "Flying Solo." (AEF)

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TAKING OFF

A TEACHER'S GUIDE TO TECHNOLOGY

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VOLUME 3 NUMBER

SPRING 199

THIS ISSUE

Taking Off

A Teacher's Guide to Technology

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DEPARTMENTS:

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IN THIS ISSUE

Behind The Mystique

At 45, I'm about the age of the average American teacher. And like most teachers, I came of age when computers were just making a debut in the world beyond science fiction. The first computer I encountered was the giant mainframe housed in the bowels of Portland State University during the early 1970s. I remember sitting in a dim, windowless room, punching codes into manila-colored cards, carefully bundling them into thick stacks, and handing them to the computer operator at the counter. Behind closed doors, my cards were read by the mainframe to analyze data I'd collected for a research-methodology class. I went back the next day to pick up a printout of the results.

The setting, the process, and the machinery all seemed mysterious, intimidating—even a little ominous. (Those of us old enough to remember Hal, the sinister computer in the sci-fi classic *2001, A Space Odyssey*, can hardly be blamed for any lingering technophobia we may harbor.)

I successfully avoided touching a computer again until I landed my first reporting job in 1981. During my first days in the newsroom, I bumbled hopelessly with the word processor. Finally, the news editor, trying to suppress a snicker at my clumsy efforts to control my cursor, strolled over and offered to help.

That's where many teachers get stuck: In most schools, there simply isn't anyone available to stroll over and help. A mere 6 percent of elementary schools and 3 percent of secondary schools had a full-time computer coordinator in the building in 1995, the Office of Technology Assessment reports. And the training available to most teachers tends to be inadequate—delivered in a hit-or-miss fashion and focused on mechanics rather than content.

"Most schools cut corners on training," is the blunt observation of Christopher Conte in a recent report on education technology from the Benton Foundation.

Report after report calls on U.S. schools to double their investment in technology training. But until that happens, the typical teacher is largely on his or her own to explore, experiment, and innovate. In this issue of *Northwest Education*, we offer readers a glimpse inside classrooms around the Northwest where teachers are using technology skillfully to teach subjects as diverse as economics and ecology. We also offer a guide to getting off the ground, giving practical tips for using the Internet and selecting software. And a longtime teacher shares her strategies for getting the most from a lone computer in a classroom full of kids.

Our hope is to provide ideas and inspiration for teachers who want to embrace technology or expand their technological toolkit. Behind the mystique, technology is, after all, just plastic and wires. Its power for learning can be unlocked only by the skill, creativity, and daring each teacher brings to the classroom.

–Lee Sherman

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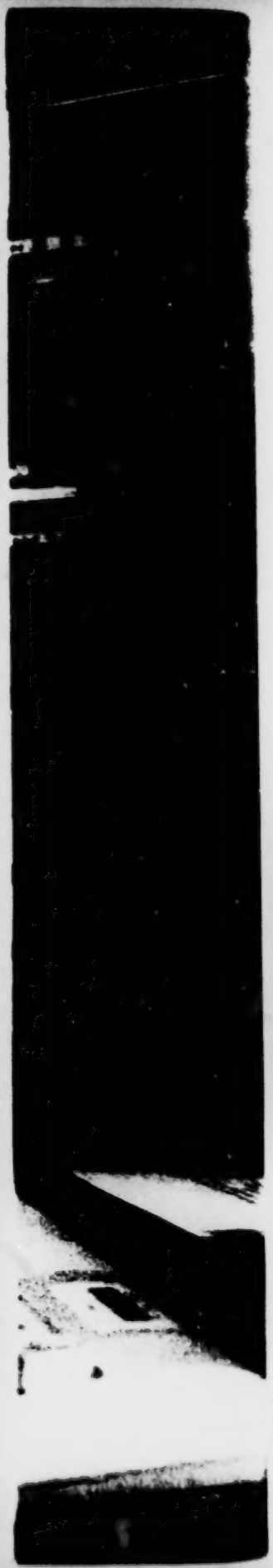

PHOTO BY DENISE JARRETT

THE PROMISE OF TECHNOLOGY

Multimedia computers, global networks, and other dazzling new tools of the Information Age have the power to transform the roles and relationships of teachers and learners—*if* teachers get the training and support they need

By LEE SHERMAN

The phone rings in the Montana principal's office.

"This is Mr. Whitehead," he answers.

On the line is a principal from Michigan. She's heard that Bruce Whitehead's school, Hellgate Elementary in Missoula, is a leader in education technology.

"I'd like to know what your scope and sequence is for your computers," she says.

"I don't ***have*** a scope and sequence for my computers," Whitehead responds.

The caller is stunned.

"But, but...how can that be? I don't understand," she sputters.

"We have a curricular scope and sequence, and computers are simply a part of that," Whitehead explains. "We integrate the computers wherever they will enhance the curriculum. We do not have a scope and sequence for technology per se."

It's not only hardware (five networked PCs per room plus state-of-the-art peripherals like digital cameras, multimedia presentation software, and flatbed scanners) that makes Hellgate a model for education technology. Rather, what makes Hellgate a standout is the way it blends gear with goals. Researchers are in unison on this point: The most amazing gizmos in the world won't help kids learn better unless those gizmos are linked to larger educational objectives.

"We are all so seduced by cool machines and the cool things they can do," says Anne Batey, a trainer and researcher with the Northwest Regional Educational Laboratory's Technology Center. "In our training, we try to keep teachers focused on the question, 'What do you want to do with ***kids***?'"

Writing in the fall 1997 issue of the *Kappa Delta Pi Record*, Dianne Kanawati defines "technological literacy" broadly to encompass not only the traditional computer-literacy skills in keyboarding, word processing, and spreadsheets but also in the latest generation of tech-

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nologies—CD-ROM, hypertext, digitally enhanced video, e-mail, and the World Wide Web. But even mastery of these advanced skills, she warns, won't guarantee that students become better learners.

"As long as we regard technological literacy as an end in itself," she says, "it will leave us as directionless as computer literacy has done."

Researcher after researcher calls on educators to view technology as a means to a greater end—improved learning—and to keep that end clearly in focus as they work to find effective uses for such innovations as Web search engines. A roomful of brand-new PCs may wow parents at open house. But by themselves, computers are just a collection of microchips and circuitry. To justify the billions of dollars U.S. schools invest annually in technology, most commentators agree, technology must become the servant of curriculum in every content area, from geography to history to ecology.

"When technology is effectively harnessed to goals identified by teachers, schools, states, and national policymakers, it becomes a vehicle for learning that is powerfully attractive," writes Christopher Conte in *The Learning Connection: Schools in the Information Age*.

Learning ***about*** computers is not the same as learning ***with*** computers, researchers stress.

"It is important to distinguish between technology as a subject area and the use of technology to facilitate learning about *any* subject area," asserts the Panel on Educational Technology of the President's Committee of Advisors on Science and Technology in a recent report. "It is important that technology be integrated throughout the K-12 curriculum, and not simply used to impart technology-related knowledge and skills."

The panel's Number One recommendation to the president, in fact, is integrating technology across the curriculum.

"Although universal technological literacy is a laudable national goal, the panel believes the (Clinton) administration should work toward the use of computing and networking technologies to improve the quality of education in all subject areas," the panel writes in its *Report to the President on the Use of Technology to Strengthen K-12 Education in the United States*, March 1997.

Nationwide, schools are struggling to make effective use of emerging technologies. A scant 3 percent earned top marks from a recent study by a group of business and education leaders, including Apple Computer, Public Broadcasting Service, and the National Education Association. The CEO Forum surveyed 80,000 U.S. schools to rate their progress on President Clinton's "four pillars" of school technology: hardware, connectivity, digital content, and professional development. The "target-tech" schools—those that are making the most of technology to "achieve maximum educational benefit"—are strong in all four pillars. These elite schools have at least one computer (many of them multimedia) for every three students, onsite technical support, high-speed Internet access, and teachers who've received many hours of training in technology use.

Of the remaining 97 percent of U.S. schools surveyed by the forum, 12 percent were rated "high-tech," 26 percent were judged "mid-tech," and the rest—a startling 59 percent—earned a "low-tech" rating. In a typical low-tech school, classrooms lack Internet connections, and computers lack the speed or memory to tap the riches of the World Wide Web, with its network of colorful, exciting sites brimming with information (both valuable and trivial) from around the world. Most computers are clustered in a lab, isolated from the regular classroom. And training for teachers is minimal. Close to half, in fact, offer no technology training at all, according to the forum's *School Technology Report: From Pillars to Progress*, released last fall.

Across America, the gaps in equipment and connectivity are closing, spurred on by deep discounts in

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the costs of wiring offered as part of the president's initiative to link all schools to the Internet by 2000. The numbers are impressive. The average ratio of students to computers, for instance, is now seven to one, compared with 125 to one in 1984. Although only 14 percent of classrooms were connected to the Internet in 1996, that was four times the number connected two years earlier.

But the growing infusion of machines and wires into U.S. schools shouldn't be mistaken for progress in teaching or learning, experts caution.

"Data on the numbers of computers, videodisk players, satellite dishes, or wired classrooms in schools can obscure crucial questions—including whether they're actually being used," writes Andrew Trotter in a special technology report published November 10, 1997, by *Education Week*.

Even the massive outlays of money and manpower needed to link classrooms to the global network are small compared to the challenge that will follow: making those connections meaningful and useful for the nation's teachers and students. Billions of dollars-worth of gleaming equipment is in danger of sitting idle—or being used only for games or drills—unless teachers learn how to blend the Internet into their lesson plans and how to match software to educational goals.

Teachers who've been out in front, successfully folding computers and other technologies into their curricula, typically have been lone pioneers—men and women with an affinity for machines, risk-takers who relish new challenges and have the time to pursue them. But these trailblazers are the exception. More typical is the teacher who is overwhelmed by the thousands of software packages on the market. Equipment glitches and shortages turn others away from technology. Simple fear stops many teachers. Others don't see how technology can improve on their tried-and-true methods. Even eager technology "wannabes" often are stymied by the steep learning curve that confronts the technology novice.

"When the computers on students' desks are mysterious devices to teachers, it's unreasonable to expect effective integration into the curriculum," observes technology expert Chris Dede in an October 1995 interview in *Educational Leadership*.

A deep chasm remains to be crossed—that of insufficient training for teachers—if technology is to become an agent for real change in the nation's classrooms. Researchers are nearly unanimous in their finding that piecemeal, ill-timed, off-target, or nonexistent training is the biggest hindrance to widespread integration of technology into U.S. classrooms.

Teachers who had taken at least nine hours of technology training were a small minority—just 15 percent—in 1994. Richard Coley and colleagues report in a 1997 study from the Educational Testing Service. Several Northwest states were doing somewhat better than the nation as a whole. Washington, in fact, led the country, with 28 percent of its teachers boasting nine or more hours of technology training. Alaska ranked next in the region with 21 percent, followed by Montana with 18 percent. Both Oregon and Idaho came in with an average figure of 15 percent.

"When the computers on students' desks are mysterious devices to teachers, it's unreasonable to expect effective integration into the curriculum."

The dollars spent for training are equally inadequate. Only 15 percent of the typical school's technology budget goes toward training teachers. The bulk of the money—55 percent—is earmarked for hardware, with the remaining 30 percent being spent on software. "Despite over a decade of investment in educational hardware and software, relatively few of the nation's 2.8 million teachers use technology in their teaching," the U.S. Congress, Office of Technology Assessment (OTA) concluded in 1995. "There are many teachers whose use of technology is marginal,

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limited, and unenthusiastic."

The training gap translates to an access gap for kids. Last year in *Computers and Classrooms: The Status of Technology in U.S. Schools*, Coley and colleagues reported that just 9 percent of fourth-graders, 10 percent of eighth-graders, and 19 percent of 12th-graders said they used a computer for schoolwork "almost daily." On the flip side, 60 percent of fourth-graders, 51 percent of eighth-graders, and 37 percent of 12th-graders said they never used a computer for schoolwork.

The OTA looked at the prevalence of computers in basic academic subjects. Only 9 percent of secondary school students reported using computers for English class, 6 to 7 percent for a math class, and 3 percent for a social studies class. In elementary schools, computers are mainly used for basic-skills practice. In middle and high schools, they are used mostly for word processing or other "computer-specific skills." More open-ended, problem-solving, or student-directed activities (desktop publishing, developing math or science reasoning with computer simulations, gathering information from databases, or communicating by electronic mail) are "much rarer," the OTA reports.

"Most in education's own ranks are still more comfortable with chalkboards than with a computer mouse," writes Mary Ann Zehr in *Education Week*'s special report on technology. The National Center for Education Statistics found that only one in five teachers regularly uses advanced telecommunications for teaching.

The President's Panel on Educational Technology and other researchers are calling for a doubling of the current training budget—to 30 percent of total technology expenditures. But simply spending more on training isn't enough. Researchers warn against relying on one-shot workshops or classes that focus on mechanics rather than content. Training should give guidance on choosing software that will help teachers meet local, state, and national goals for student learning. It should provide strategies for making efficient use of one or several computers in a 30-student classroom. And it should be bolstered by ongoing, onsite support—an expert whom teachers can call on when equipment fails and a mentor they can seek out when questions pop up.

"What teachers actually need," the panel writes, "is indepth, sustained assistance as they work to integrate computer use into the curriculum and confront the tension between traditional methods of instruction and new pedagogic methods that make extensive use of technology. Such assistance should include not only purely technical support, but pedagogic support as well, ideally including classroom observation within the classrooms of successful technology-using teachers, periodic consultation with more experienced mentors, and ongoing communication with other teachers grappling with similar challenges."

Coley and colleagues recommend that staff development for technology integration should:

- Be driven by a clear understanding of the local needs of teachers
- Emphasize hands-on experience, especially for technology use training
- Use peer coaching rather than lecture format
- Integrate technology training into other staff development programs in the school and district
- Involve administrators as participants with teachers in staff development programs on technology use and integration in the curriculum
- Provide the release time needed for teachers to apply what they learned in training
- Provide follow-up support for implementation of technology skills learned in training
- Give teachers access to resources needed to implement what was learned in training
- Facilitate communications among teachers—use telecommunications technologies to help teachers communicate and share their professional experiences

One training strategy strongly supported by research is the development of teacher-mentors or

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onsite master teachers who can guide their co-workers toward technological proficiency. About 60 Washington teachers—some from very isolated schools—are being groomed as technology mentors through a project developed by the Northwest Regional Educational Laboratory's Technology Center in partnership with Washington's Education Service District 112. The project's goal is to identify and nurture building-level leaders—"a person in every building who is willing to share with other adults," says Anne Batey, who coordinates staff development for the project. The project, funded by a grant from the state of Washington, not only provides technology-rich classrooms but pays for substitute teachers to fill in for participating teachers while they develop leadership and mentoring skills with educational applications of technology. [For information on the TELDEC project—Technology and the Essential Learnings: Developing Effective Classroom Projects—contact Anne Batey at (503) 275-9605 or bateya@nwrel.org.]

The kind of "indepth, sustained assistance" researchers recommend takes not only money, but also that equally elusive commodity: time. The OTA, in fact, calls teachers' time shortage the "biggest barrier" to technology use in classrooms. Schools that have excelled in bringing technology to learning have provided teachers with time to attend trainings, explore software, seek help from colleagues, and plan lessons that incorporate new technologies. These teachers have time to investigate online projects, visit Web sites, search for curriculum materials, and exchange ideas with a worldwide network of educators. They have time to simply "mess around" on their computer, the OTA reports.

"Teachers are given very little compensated staff development time, and there are multiple, competing demands for this time," the OTA observes. "Unless there are significant changes to the rhythm of the school day or changed incentives for giving teachers more time to learn and experiment with new technologies, this barrier to technology use will remain immense."

Pinpointing "onsite assistance from a full-time computer coordinator" as an especially critical resource for teachers, the president's panel notes that not even 5 percent of schools have such a full-time professional on staff. And even when a full-time coordinator is in the building, she typically devotes the bulk of her time to hardware and software maintenance and to teaching or supervising students—not to helping teachers.

> "Most in education's own ranks are still more comfortable with chalkboards than with a computer mouse."

For teachers who want to plunge in on their own, avenues beyond the schoolhouse are available. Throughout the Northwest, for example, universities and educational service districts (ESDs) operate technology resource centers for teachers. Services vary from center to center, but may include software collections, curriculum materials, workshops, inservice training, planning assistance, hardware and software consultation, discussion groups, and information libraries. In Alaska, British Petroleum is funding the development of 15 "Teacher Exploration" centers around the state. [Contact your state education department, local ESD, nearby university, or the Northwest Regional Educational Laboratory's Technology Center for information about resource centers in your area. For more guidance on getting started with technology, turn to "Conquering the Computer" on Page 32.]

Even with an ideal mix of training and ongoing support, the president's panel estimates that the typical teacher will need three to six years to "fully integrate information technologies into his or her teaching." The Office of Technology Assessment suggests five years as "the appropriate time frame for large-scale technology infusion."

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"Effective technology implementation takes more time and effort than many anticipate when first undertaking technology initiatives," the OTA reports. "Change is not sudden and dramatic; it takes hard work on the part of many people over time to see the benefits of the endeavors."

More than a few observers have questioned whether the pay-off in student learning is worth the huge investment of taxpayer dollars and teacher effort. Writing in the *New York Times*, technology critic Ethan Bonner recently panned the "glorified video games" that sometimes pass for education on computers. He questioned the "vague but firm belief that access to information, regardless of quality, must be good." Theodore Roszak lamented finding "an awful lot of junk, advertising, and trivia" on the World Wide Web. Samuel Sava, executive director of the National Association of Elementary School Principals, expressed his skepticism this way in a recent *Education Week* article: "I'm very concerned over the rush to purchase hardware when we do not have enough evidence on how best to use computers to help youngsters achieve in reading, mathematics, writing, et cetera. My second concern is that a number of school systems, in order to purchase the hardware, have begun to eliminate such key programs as the arts."

Most experts agree that educators should not put all their school-improvement eggs in the technology basket. Technology alone does not contain the golden key that will unlock knowledge, skill, and wisdom for all children. "Computers should not be seen as the replacement for traditional methods of learning," muses Amy Derby, resource librarian for the Northwest Laboratory's Technology Center. "Rather, I think the old and the new augment, supplement, and enhance each other. A visit to a virtual museum is not the same thing as a visit to a real museum. Or, to put it more personally, I don't want to curl up with my PC in front of a cozy fire to read."

But the question, Does technology boost student performance? has not yet been answered. Isolating the effects of computers from the overall classroom culture has proven difficult, researchers say. "Additional research is needed," the OTA asserts, "to develop a deeper understanding of which instructional uses of technology are most effective and under what circumstances, and how teacher interaction with technology plays into this effectiveness."

There does appear, however, to be a clearly established link between technology and attitudes. When students use high-tech tools, studies show, their motivation soars. A 10-year study by Apple Computer found that students who had access to learning tools such as multimedia computers and video cameras became more independent learners, worked more cooperatively, and shared their expertise spontaneously, among other changes in outlook and behavior.

These changes reflect what many advocates now see as technology's greatest educational asset—its ability to free teachers and students from the rigid roles of old: teachers as spouters of knowledge, students as sponges to soak it in. In this brave new world of learning, students play a more active role in their own education. They speculate, explore, experiment, discover, share, collaborate, present. Their tasks are often "authentic" (real-world) projects in which they gather data from their school, neighborhood, or community. Their findings can contribute to scientific understanding or change public policy. In this new kind of classroom, students take responsibility for their own learning, solve complex problems, and apply reasoning skills to current issues. "Instead of absorbing an established body of knowledge delivered to them by teachers," Conte writes, "they are developing skills to seek, sift, analyze, and convey information themselves. Instead of studying in isolation, they are working on teams. And instead of regurgitating what they have learned back to their teachers, they are communicating their findings to a much wider public."

Such a seismic shift in learning requires a sometimes-wrenching shift in teaching. One technology-using teacher describes his new role as "facilitator,

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stage director, resource manager, master learner, discussion leader, observer, and evaluator."

Such changes will not be easy or automatic for most teachers. "If the goal of using technology is to change how teachers teach and how children learn," the OTA counsels, "then teachers will need support and training to learn new pedagogical methods. More technology or more use of technology will not be sufficient to assure other innovations or reforms."

Every technology, no matter how dazzling, needs a talented teacher to guide its use in the classroom. Otherwise, as the OTA warns, computers may be used merely as "electronic blackboards."

"A gulf exists," says the OTA, "between the ambitions of technology experts and software developers and the practice of teachers in classrooms. Helping teachers use technology to facilitate different educational philosophies and teaching practices will require substantial change in curriculum, instructional methods, and teacher understanding." ■

SCHOOLS FOR A NEW MILLENNIUM

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Flying

THE *Queen's Beans*

BY LEE SHERMAN

MISSOULA, Montana— For David Bixby, steering a roomful of fifth-graders through the treacherous shoals of learning is like climbing the icy north face of Mt. Rainier.

"There's a potential for disaster all the time, and there's also the potential for glorious success," says Bixby, a first-year teacher at Hellgate Elementary School in Missoula, Montana. "I get the same kind of high from teaching that I get from mountaineering. Things can go so well, and they can go so wrong, and I need to continually improve my skills."

Hellgate Elementary offers plenty of opportunities for Bixby and his colleagues to build their skills. A hotbed of technology set implausibly in the wilds of western Montana, Hellgate has five computers and a color printer in every classroom. It has digital cameras, LCD (liquid crystal display) projectors, a flatbed scanner, and access to a sophisticated lab at the middle school next door, where students can experiment with real-world skills such as computer animation, robotics, broadcasting, rocketry, and Web page design. Field studies—an ongoing archaeological dig, for example, and a habitat study carried out jointly with the University of Montana, the U.S. Forest Service, and Montana Fish, Wildlife, and Parks—provide more opportunities for linking technology to learning goals.

This high-tech haven was just the place for Bixby, who had used state-of-the-art hardware and software to crunch data and map coastal waters as a hydrographer (an underwater mapmaker) for the National Oceanic and Atmospheric Administration. He weaves his techno-tools into all corners of the curriculum. For example, his students will become amateur surveyors and hydrographers when they use rods to measure the depth of local McCormick Pond, and then enter the data on spreadsheets to graph cross-sections of the pond (software: Microsoft Excel). Bixby hopes to find a piece of "shareware" on the Internet that can use the students' data to create a contour map—the first one ever made of McCormick Pond.

Posted around the room are Web sites for general research, such as the self-described "mother of all search engines" (http://www.mamma.com), or for specific information, such as the journals of Christopher Columbus (http://www.fordham.edu/halsall/source/columbus1.html). Bixby's kids build skills in tracking down data through Internet scavenger hunts.

His students' research reports take the form of "virtual field trips" where classmates can share, for example, an exploration of Mt. Rainier, a walk on Mars, or a wild-mushroom hunt. Students are learning to bring their multimedia presentations alive with music (software: Microsoft PowerPoint). One recent morning, for instance, Nicole, a student with Blackfeet ancestry, was noodling with the sound mixer on her computer, trying to coax just the right tones from her *Indian Moments* CD for her presentation on Montana's

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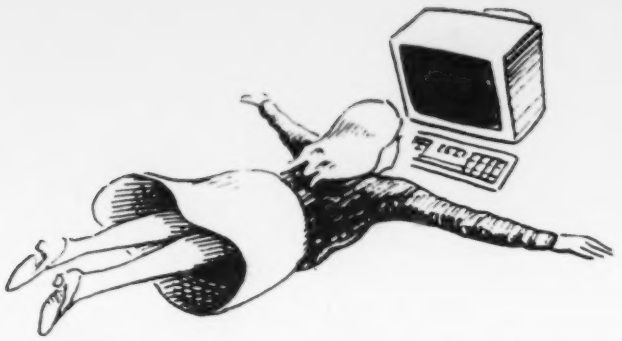

HIGH

From the 'burb of Bellevue to the burg of Helena, from the metropolis of Portland to the hamlet of Shelley, Northwest teachers are guiding students toward learning goals on the wings of technology

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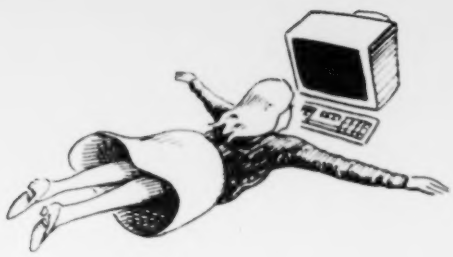

Native American tribes.

Even free time in Bixby's room is laced with technology. Instead of offering extra recess as an incentive for good behavior, Bixby pulls in hordes of kids every Thursday for a planetarium presentation on a Power Macintosh (software: MacAstro). Night sky images projected on a screen can zoom in for a close-up view of planets, stars, and whole galaxies. By year's end, students will have added celestial navigation to their accomplishments.

A recent lesson on mathematical pattern analysis had Bixby's kids transfixed. The problem—about a Web-savvy queen and a math whiz named Bob in a land where the coin of the realm was a golden bean—went like this:

Once, a long time ago, the queen of a far-away land needed to hire a gardener to take care of her garden of a thousand roses. Soon after she put a notice on her Web site saying she needed a gardener, she received an e-mail message from a mathematician. His letter stated that work in the math field was hard to come by and he wanted to take a try at gardening. The queen replied, "Since it sounds like you have very little gardening experience, I would have to start by paying you 100 gold beans for the first year. After that, for the next 15 years, I will increase your pay by 100 gold beans each year. For surely you will become a better gardener and worth more beans each year."

The mathematician, who called himself Bob, replied with a fax: "I cannot take such a generous offer. I propose that you pay me just one gold bean the first year, and then as I become a better gardener, double my pay each year until I retire in 15 years."

The queen created a spreadsheet to determine whether she should take Bob's offer or stick to her own plan.

The students' task was to respond to the following instructions and questions:

- Describe your plan for solving the problem.
- What will she find out? Make a prediction.
- What is the total amount of money she will pay with her plan?
- What is the total amount of money she will pay with Bob's offer?
- Describe how the bar charts of each plan are different and why.
- Explain how you solved the problem.
- Explain whether your prediction was correct or not.
- Even though Bob may not be a very good gardener, is he a good mathematician? Why or why not?

Pairs of students confer at their desks as Bixby strolls between desks, offering guidance and answering questions. Student pairs begin heading for the waiting computers, spilling into the spare classroom next door to attack the problem. Using a spreadsheet (software: Microsoft Excel), Jeff and Jesse collaborate on entering the queen's beans in one column, Bob's beans in the next. They then instruct the computer to fill in the numbers for the next 15 years. Across the room, Derek has an insight. "Hey, she was trying to cheat him," he protests, as he discovers, along with Jeff and Jesse, that the queen's offer nets Bob only 12,000 beans. Bob's plan, on the other hand, would earn him 32,767 beans.

The color printer begins to hum, and soon out rolls Jeff and Jesse's bar chart—a graphic depiction of the ever-widening discrepancy in projected earnings between Bob's and the queen's plans, generated instantly by the computer.

"I liked that," Jeff enthuses afterwards. "That was a cool problem."

Remarks Bixby: "I could never get them to be on-task for so long in paper and pencil. They really get focused when they work on the computer."

Teaching kids how to use spreadsheets "makes a valuable pre-algebra lesson," Bixby observes. "Spreadsheet functions, formulas, graphs, and charts are algebraic." Spreadsheets also give students "a clear visual layout of numbers and number relationships independent of the child's drawing and organizational skills," he notes. Another advantage of keyboards over graphite: Kids can think more deeply and broadly without getting bogged down in computations. While computational skills are important for kids to master, an error in arithmetic can mask the student's mastery of a larger concept, Bixby notes.

"The computer can perform higher-order operations on data much more quickly than students could do with paper and pencil," Bixby explains. "It extends their thinking."

Getting kids to reason, analyze, and evaluate—the "higher-order" kinds of thinking that countless reformers and critics say schools should cultivate—is Bixby's true quest. Setting students loose on the Internet, and then having them assess the quality of information they encounter, is an authentic exercise in critical thinking, he says. "There's no limit to who can place information on the World Wide Web."

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he says. "Consequently, there's no guarantee as to the quality of information on the Internet. Students need to become critical information users."

Bixby suggests that teachers have their class develop a system for rating the quality and reliability of Internet sites. A checklist might answer such questions as: What is the goal of the site—education, advertising, entertainment? Who maintains the site—university, government agency, nonprofit organization, business? Is the site trying to persuade the user to adopt certain ideas, or is it just providing factual information? Does the site give sources for its information?

Summing up the plusses of computers for students, Bixby says: "Technology in our classroom offers immediate feedback to students during problem-solving activities.

"And," he adds, "it gives us a direct link to the real world."

TEACHER'S FOOTNOTES

On presentation software:
"We use Microsoft PowerPoint, which includes PowerPoint Viewer as part of the package. The viewer is a small program that plays presentations but does not allow you to create them. It's used for taking presentations on the road. You can use the viewer to show your presentation on any computer so that you don't have to install the whole software package. It's available for free distribution."

On the story problem:
"The Queen's Beans problem is based on a traditional Chinese tale about a wise peasant who tricked the emperor into paying him a single grain of rice on the first day and doubling the amount until, in a surprisingly short time, the kingdom was bankrupt." The children's books, *A Grain of Rice* by Helena Clare Pittman and *One Grain of Rice: A Mathematical Folktale* by Demi, are based on the tale.

On astronomy software:
"The astronomy software I use with my Macintosh, as well as other software that will run on PCs, is available as shareware from http://www.ralentz.com/old/astro/home-astro.html."

PHOTOS BY ROBERT MERRIMAN

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LITTLE WIZARDS

BY LEE SHERMAN

PHOTO BY CAROLE ARCHER

PORTLAND, Oregon— The kindergarten classroom at Markham Elementary School brims with the usual kindergarten props and materials. Easels and felt-tip markers in rainbow colors. Tubs of Legos and big wooden blocks. Colored paper, blunt-tipped scissors, buckets of crayons, big picture books. A friendly ferret snoozing in a cage. Personal computers.

Wait, back up. PCs? How does the hum of hardware blend with little voices singing silly songs or with tiny tennis shoes pattering on linoleum? How do CD-ROMs mix with scissors and crayons? Does technology really fit into an early childhood learning environment with its emphasis on play and exploration?

Like a child's hand in a warm mitten—if it's done right, says teacher Gene Casquerro.

Technology must become a natural part of the classroom environment, Casquerro says. It needs "to be an extension of everyday life." He strives to weave computers seamlessly into activities geared to young children's growth and needs.

His efforts are evident in his room, where students divide the bulk of their time between math activities ("Math Tubs") and literacy activities ("Centers" and "Writers Workshop"). One recent morning, when each child was occupied at one of the dozen "centers" set up around the room, technology was everywhere. Yet it was folded so skillfully into the larger fabric of the room, a visitor might easily miss it in the hubbub of building, drawing, cutting, pasting, paper rattling, and collaborative chattering.

"Boys and girls, remember: Exercise your brains and not your feet," Casquerro gently admonishes as the children settle into their projects. At the Pet Shop Center, Kayli works intently, designing and drawing a digital toy ladder for Fraidy-cat the ferret, who yawns and stretches in his cage after a morning nap. Next to Kayli's PC is a sign bearing the challenge for the week: Using KidPix, can you create a toy for our classroom pet? (Software: KidPix Studio by Broderbund.) Across the room at the Block Center, a sign reads: USING BLOCKS, CAN YOU CREATE A DESK FOR A COMPUTER AND PRINTER? Alexis and Avecena are busily building a computer desk to hold a set of cardboard boxes mocked up to look like computer components. Beside the girls, Alex is taping strands of orange yarn to another set of cardboard components. "I connected everything to the hard drive," Alex announces as Casquerro stops by to check on the children's progress.

Over in the Science Center, where the posted challenge is CAN YOU EXPLORE THE INSIDE OF A COMPUTER USING A MAGNIFYING GLASS?, Karen wears a white lab coat and, sitting at a table strewn with disassembled

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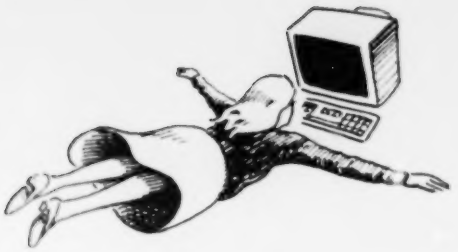

computers parts, peers intently at the magnified jumble of rainbow-colored wire on a circuit board. Nearby, Ibrahim sits at one of the classroom's six PCs in his lab coat, viewing a CD-ROM called *How Multimedia Computers Work* (published by The Software Toolworks Inc.) which at this moment is explaining the mechanics of a mouse. A Kurdish refugee from Kuwait who doesn't speak much English, Ibrahim seems undaunted by the English narration on the CD.

"Computers break the language barrier," remarks Casqueiro, who has four Kurdish refugees, two Somalis, and two Spanish-speaking kids among his 27 morning students.

Meanwhile, over in the Easel Center, Josh is finishing a cheerful drawing of his mom standing beside a potted flower. CAN YOU CREATE A PICTURE PROGRAM FOR THIS COMPUTER? is the challenge for this center, where Casqueiro has drawn a simple outline of a computer on each drawing pad. Josh's "MomWare" is displayed on the make-believe monitor. The boy completes his work by coloring the components in vivid shades of orange, green, and blue.

On days when Casqueiro's kids do Math Tubs instead of Centers, computers are evident, as well. While some children make paper chains or fill in circles with crayons during a recent lesson on patterns, other kids use KidPix to create patterns of virtual rubber stamps. Sabrina giggles as frogs multiply wildly on her computer screen. "Look at those frogs!" she says, gleefully. "They're so funny!" After some experimenting, she abandons the frogs in favor of lollipops alternating with wiggly worms. Kayli creates a pattern of two eggs, two raccoons, two eggs, two raccoons. Chloe makes a series of rubies, emeralds, diamonds, and rabbits.

A quick thumb through Griffin's math portfolio reveals his fondness for elephants, which pop up again and again in computer-generated patterns with ostriches, snakes, and other creatures. Griffin's elephant fixation seems linked to his love of Irvin, the gregarious elephant puppet who, from time to time, pops out of Casqueiro's "transporter," a mysterious bucket covered with all sorts of technical-looking gizmos and thingamajigs. Irvin led a recent lesson on "Computer Wizards," in which he hung photos of computer components and accessories (such as a mouse pad, a printer, and a floppy disk) on a felt board, and asked the students to name them. When "programs" showed up on the board, Irvin couldn't restrain himself. "I know one of the programs!" he blurted out excitedly. "KidPix! KidPix is one of the programs!"

Casqueiro likes KidPix because it's a child-directed program, rather than a computer-driven program—one that leads the student through a series of drills, for example. "Too many parents and teachers see the computer as a glorified worksheet, and it's not," he says. "Open-ended programs like KidPix permit a broad range of possible strategies and outcomes."

The Number One message he hopes to instill in his kindergartners, he says, is that people drive technology. "Too many children think the computer controls them. A child should learn that technology can be controlled by someone, and that he or she can be that someone."

TEACHER'S FOOTNOTES

On software:

"Bailey's Book House, Millie's Math House, and Sammy's Science House by EdMark are absolutely fantastic."

On money:

"In the Portland District, teachers get about $80 to $100 a year to buy everything—curriculum materials, supplies, books, software. With a CD running about $34, that doesn't go far. A recent school improvement bond measure that paid for computer hardware and installation was a little bit thin on the software side. So you have to be creative. I've been able to find some additional money through the PTA, and I found one software publisher that was having a two-for-one special. Through our parent volunteer program, parents can come in and read to the students and then donate a book—or a piece of software. And I bought all my KidPix software myself."

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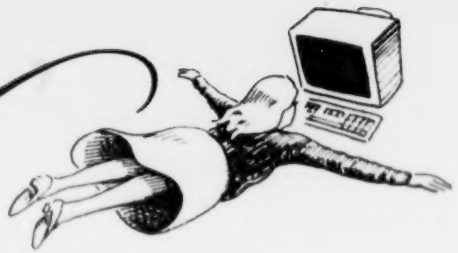
Wood Wind



By CATHERINE PAGLIN

BELLEVUE, Washington—It's mid-morning in the Technology Education class at Highland Middle School. The "dirty room" buzzes with students drilling, sawing, and sanding. Wood dust fills the air. Teacher Dennis Crane, an intense, long-legged bicyclist, rushes from one end of the 75-foot-long shop to the other, by turns advising, correcting, and encouraging his 26 seventh-graders.

Today the class is in the middle of a unit on magnetic levitation, the principle that allows the bullet trains of Japan to reach speeds of 310 miles per hour. Students are at all stages in the process of designing, building, testing, and documenting the performance and characteristics of a MagLev vehicle shaped from a 2-1/2" x 2" x 6" piece of balsa wood.

"We're trying to get it aerodynamic," says one student, sanding furiously at his block of wood.

"Frank, come here Frank, check out the drag," shouts another student as he peers at his vehicle through the window of a wind tunnel.

A small group of boys and girls clusters around a stretch of track to witness the maiden voyage of a red-and-black, cigar-shaped car. The car—velcroed to a flat, rectangular plastic platform with four magnets on its underside—is levitated by opposing magnets in the track. Externally powered by a two-second burst of air, the aerodynamic but impractically shaped vehicle travels an impressive 24 feet, 7 inches.

At 10:53 a.m., a chorus of "Clean up, clean up" arises, and there's a flurry of activity as students push brooms, put away tools, and turn off machinery.

After a four-minute break, Crane is back at work. The next section of Tech Ed—his third of the day—begins in the adjoining "clean room," which houses computer terminals, a Quick Cam digital camera, video monitors, design drawings, and models.

At this school, Technology Education—a required class for all seventh-graders— is where low tech and high tech meet. Here, students lay hands on every kind of tool—from wrench to wind tunnel, from drill press to database, from screwdriver to digital camera.

"There's an image of Tech Ed as what used to be called shop," says Crane, recalling that when he began teaching at Highland 13 years ago his students made ice scrapers and oven hooks from patterns and plans. "Whereas shop was a really valid program at the time, Technology Education is a lot more valid now. It takes a problem-solving approach rather than a project-making approach."

Documentation, including electronic documentation, is a major piece of the new approach, as is evident in the MagLev project. Over the last three years, Crane's Tech Ed classes have built up a MagLev vehicle database containing close to 400 entries. Today most students are just creating a file and entering the basics—name, class period, student number. Later they will enter their vehicle's weight, the drag it created in the wind tunnel, a drag rating (a ratio between the drag on the MagLev vehicle and the greater drag created by the original, unshaped block of wood), and the distance the vehicle traveled on the track. To round out their database entry they will snap a Quick Cam photo of their finished, painted creation.

"When the computer end of things came in as part of this project, one of my goals was to model the use of technology," says Crane. "Every student in seventh-grade Tech Ed will be using technology to gather information."

Though he has done the MagLev project without the electronic tools found in the clean room, Crane finds the database a powerful motivator for his students. Early in the project, before students begin brainstorming design ideas, he can project data and images from previous years onto his two video monitors. Students can see how former students—such as students' older brothers and sisters—have solved the problem, and what kind of performance results they achieved.

Initially, Crane was concerned that students would want to duplicate the most successful designs in the database, but this hasn't been a problem. He tells his students, "That may be a beginning point. *He* did OK, but *you* can do better" and "I'd hate to say that *that's* the way to do it when *you* have a better idea."

The shared database has the potential to extend the MagLev project outside the school. Crane has already collaborated with an instructor at Tillicum Middle

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PHOTOS BY CATHERINE PAGLIN

School, also in Bellevue, on a unit on bridge design. In a database shared between the two schools, students entered digital photographs of truss-style bridges they built from 25 pieces of 1/4" x 1/4" x 13" pine wood. They recorded each bridge's weight, the type of adhesive used, the weight load at which the bridge failed, and the strength-to-weight ratio.

"This was really a motivator, because kids wanted to make sure their bridge would beat Tillicum's," says Crane. "Because it was going on concurrently, the kids would just come in and go 'I want to go online. Did they get any more in?' and 'Where are we now?'"

Ideally, Tech Ed classes in the district's five middle schools, and even from schools beyond, would feed information into the shared database, says Crane.

However, it takes more than an electronic connection to make meaningful links between schools. Crane and his colleague have not been able to coordinate the MagLev project because of differences in test equipment. Tillicum has a more sophisticated wind tunnel and track set-up than Highland; therefore, student test results would not be comparable. Even the bridge design project, for which the two instructors strove to standardize their test equipment, cannot always be done simultaneously because of scheduling differences—Highland is on semesters, Tillicum on trimesters.

But Crane is convinced that the effort required to set up computer-based projects and solve practical difficulties pays off in the long run. "Using instructional technology in a project like this makes for a much better project," he says. "Because it's computer based, it's easy to adjust and modify to meet new needs." For example, Crane notes that as the projects evolved, he added new information categories and the digital photos to the MagLev and bridge databases. "Once you get past the frustrations, the final project is well worth it."

TEACHER'S FOOTNOTES

On the assignment:

"Before building a vehicle, students must identify the problem; brainstorm and sketch from two viewpoints a minimum of 14 possible solutions; do quick three-view drawings of their three best solutions; do a very neat and accurate three-view working drawing of the best design; and write a list of working procedures (processes and machines in the order in which they will be used). After building and testing the vehicle and entering the required information in the database, students must render the vehicle in two-point perspective. A second part of the assignment requires students to design a logo for their MagLev vehicle company."

On the software:

"We use FileMaker software for this project for several reasons. FileMaker is a database in which you can design a variety of different layouts. Once you know how to use the program, it's fairly flexible, which makes it easy to modify to better meet the goals of the lesson. Students are able to search, sort, and modify their own records as well as compare their results to the results of their classmates. But probably the major reason we use the software is that FileMaker allows you to share data over a network. Students are able to log on to any computer connected to the building or district network, launch the program, enter a password, and then have access to view and even modify records. FileMaker has security features that permit you to designate different passwords for different levels of security (student level versus teacher level). We have found it to be useful for many grade-level projects, such as the eighth-grade cultural fair and sixth-grade book reports."

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Roe Show

By DENISE JARRETT

PHOTO BY DENISE JARRETT

ANCHORAGE, Alaska— Daniel has been to the creek where the salmon are spawning, and he wants you to know something: "The fish are nasty and slimy." The recording of the second-grader's voice coming from the computer speaker is soft and careful. These are the words he wrote, too, above his drawing of a person standing in a creek. The figure is holding a hapless salmon in the air. In the water below, a luckier fish darts between the figure's legs.

The drawing is bold and clever, and the boy's recollection of touching the salmon at the creek is vivid. His teacher, Sue Olsen, is delighted.

"Daniel is a very good student but very, very quiet," she says. "He is bilingual, and his family only speaks Chinese at home. So when he showed us the drawing he did on the computer, we thought it was terrific. We all thought the word 'nasty' was a great word choice—funny and apt. The visit to the creek was a very distinct experience for him. Something about working on the computer allowed him to express that, where he probably wouldn't otherwise."

Daniel and his classmates at William Tyson Elementary School are participating in a salmon incubation project sponsored by the Alaska Department of Fish and Game. The project is the focus of a year-long science unit on cycles in nature.

Last fall, Olsen and fellow teacher Cheryl Ondra took their students on a field trip to Campbell Creek in South Anchorage. There, Fritz "Fishman" Kraus, the biologist who founded the program, took a male and female coho salmon from the stream and artificially fertilized the eggs. Making an incision down the female's underbelly, Kraus showed the students the red roe glistening inside. The students were awed.

"They were overwhelmed with the sheer number of eggs—they just couldn't believe it," recalls Ondra. "They wanted to know, 'What would she do with all of those babies?'"

To get an idea of what it's like to rear all of those "babies," Kraus helped the students place about 250 of the eggs in a cooler for transport back to their school. There, the students lowered the eggs into a specially prepared fish tank where the eggs will incubate for about eight months, first growing eyes, then a rudimentary tail and "yolk sac," and, finally, the tiny fins of the fry. By May, the fry will have grown large enough to be released into Taku-Campbell Lake, a landlocked lake inside the city limits. To avoid contact with wild salmon stocks, the fry must be released into a lake that doesn't feed into a stream.

As the students observe the development of the salmon eggs for several months, they record what they see and learn in drawings and writing assignments. Each day, they log the water temperature and any physical changes in the eggs in a notebook next to the fish tank.

Ondra and Olsen, who team teach, recently added another dimension to the salmon-cycle curriculum: computer technology. Computers allow students multiple ways of expressing themselves, the teachers say. The explorative nature of the Internet and desktop publishing and presentation tools such as Kid Pix Studio or ClarisWorks increases students' motivation, creativity, and problem-solving, they say.

Working with Chery Bradley, the school's Title I technology specialist, they have integrated the computer into all aspects of the salmon project. Their students create their drawings and writings on the computer, incorporating recorded narration and a photograph of themselves into a multimedia presentation. Using a desktop presentation program (Kid Pix Studio), they are building a slide show that will take viewers from their creekside adventure, through each stage of fish development, and to the shores of Taku-Campbell Lake where they will set their fish free.

But the project doesn't end there. Students will collect their slide shows into one file and, with the help of their teacher, copy it from a computer to videocassettes.

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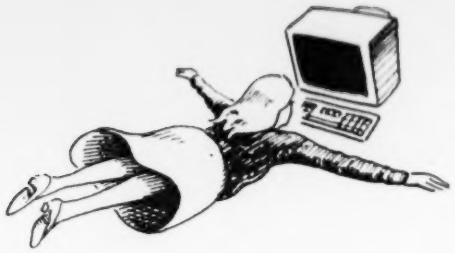

Then they will take their videos home to show their parents what they know about the role of cycles in nature, fish development, and multimedia computer technology.

Many parents are still uncertain about the computer's role in the classroom, Olsen says. They don't know what to think when their children use terms like linking, storyboarding, and downloading.

"Many of them have a hard time comprehending what their children are talking about," she says. "Sometimes parents think they're just playing. But how do children learn? They learn through their play."

When students show their parents their slide shows, Ondra says, parents clearly will see the curriculum being taught—earth science, reading, writing, editing. They will see the concepts their children are learning: the role of cycles and timelines in nature; salmon development; and the importance of salmon to Alaska's culture, environment, and economy.

The computer can be a valuable tool to help teachers meet the needs of diverse learners. Three-quarters of the students at Tyson are Alaska Native, American Indian, African American, Hispanic, Asian, or Pacific Islander. Some speak English as a second language. Many of their students are thriving, the teachers say, because the computer facilitates their expression, helping them to demonstrate their knowledge in a variety of ways—visually, orally, and in writing.

Computers can help students in many aspects of their learning, Bradley agrees.

"Each time the students work with their pages of art and writing, and assemble them into a multimedia presentation, they revisit those core concepts," she says.

The computer is especially suited to helping students create their own representations of knowledge. As they draw, students can choose to add computerized design elements such as patterns, borders, and colors. They can place graphs, photographs, clip art, or animated transitions between slides. They can write text onto their drawing, and they can include sounds or a recording of their own voice. And they can do this with a high degree of autonomy.

This gets students excited.

"Any time a child gets excited, you think, 'Wow, this is a good thing,'" says Olsen. "When you get excited about something, you learn it better. As an educator, you want to find what sparks the interest of your students. When you find it, it's like the light at the end of the tunnel."

TEACHER'S FOOTNOTES

On getting started:

Olsen: "For practice, students can start off with a simple slide show about their favorite foods. So when they start the big salmon project, they'll have an idea about what it's going to look like in the end, how it's going to run like a movie, and how they can put their voice in there. It gives them time to play with the program before jumping into the big project. You can do other projects on cycles that require less time by using seeds, frogs, worms, or water cycles. The life cycle of a butterfly is a really easy one and the kids love it when the butterflies pop out of their pupas!"

On hardware:

Bradley: "In order to record students' voices, computers need to have either an internal or external microphone. To copy the slide shows from a computer to a videocassette, you need an S-video cable that plugs into your CPU and into the back of a television that is hooked up with a videocassette recorder. You play the slide show on the computer while the VCR is recording."

On the Internet:

Ondra: "We have to have written parental permission for the kids to be able to use the Internet, as well as for us to publish students' work on our Web site." Olsen: "We usually explore the Internet as a whole class. From my computer, I put the sites up on a television monitor and we talk about what we find. But we don't download anything. Their slide shows are for their direct experiences only. We've found some good sites on salmon cycles:

- http://www.state.ak.us/local/akpages/FISH.GAME/notebook/notehome.htm
- http://www.state.ak.us/local/akpages/FISH.GAME/cfmd/geninfo/research/genetics/kids/kids.htm
- http://www.riverdale.k12.or.us/salmon.html

On salmon/trout programs:

Alaska Department of Fish and Game, Anchorage, Fritz Kraus, (907) 267-2265; **Washington** Department of Fish and Wildlife, Olympia, Bonnie Long, (360) 586-3106 or e-mail, longbkl@dfw.wa.gov; **Oregon** Department of Fish and Wildlife, Portland, STEP Coordinator, (503) 872-5252, extension 5431; **Idaho** Department of Fish and Game, Boise, John Gahl, 800-422-9453 (within Idaho only) or (208) 334-2633; **Montana**, Montana Fish, Wildlife, and Parks, Helena, Dave Hagengruber, (406) 444-9736.

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SCIENCE

By TONY KNEIDEK

PHOTO BY ROBERT BOWER

SHELLEY, Idaho— The 1979 nuclear accident at Pennsylvania's Three-Mile Island complex seems a long way from a high school classroom in this Eastern Idaho town tucked into a bend of the Snake River. But Shelley High School junior David Huntsman sits at a computer creating a three-dimensional truck like the ones that next year will begin transporting nuclear fuel rods damaged in the accident from one Idaho storage facility to another 35 miles away. At a nearby computer, classmates Stefanie Empey and Jeff Neitzel make three-dimensional models of the trailer that will carry the radioactive load and of the cylinders that will store the spent fuel rods.

The students, working from designs provided by engineers at the Idaho National Engineering and Environmental Laboratory, are involved in more than a complex classroom assignment to create a 3-D video. Once completed, the students' graphic representations may well add to public and congressional understanding of the risks of moving nuclear waste—in this case from "wet storage" to a safer "dry storage" facility at the national laboratory about 60 miles northwest of Shelley.

"I currently have a scale model of the (waste transportation and storage) system that I haul around in a small suitcase," says Joe Carlson, manager of the Three Mile Island-Unit 2 Dry Storage Project for the Idaho National Laboratory. The $30 million project involves the transport of 344 canisters of nuclear core materials "severely damaged" in the Three Mile Island accident. Scheduled to begin in 1999, the project "is highly visible and politically sensitive," he notes. Carlson says the video being developed by the students could be used for training workers, developing procedures, and making presentations. "Depending on the detail and depth that these kids can take their project, I could see a broad range of uses."

The student work is a part of the Science Solutions class they take at Shelley High School. Teacher Mike Winston, who developed the curriculum now being used in high schools throughout southeastern Idaho, describes it as an integrated, problem-solving, service-based approach to education. "The class is based on schools actually helping to solve community problems—on kids working and getting involved in the issues in their community," he says.

Winston has developed about 30 alliances with environmental, engineering, and energy agencies, the medical community, the school board, and state agencies such as the education and transportation departments. From the alliances come partners and mentors who work with the students. "We screen the projects to determine the ones with the most educational value," Winston says. "It takes a lot of cooperation."

But it's not just the students who benefit. "The businesses have something vested in the projects," Winston says. "They provide the mentors, and we're working together on viable solutions. This helps them as well."

Science Solutions, a year-long elective at Shelley, involves each student in one of about 12 projects during the school year. Many, but not all, of the projects require technological applications. Winston developed the approach after interning one summer at the Idaho Energy Laboratory. "I just went around and started asking the scientists and engineers what they needed from the school and students," he says. "The main skills they were looking for were communication, problem solving, and working together. I was surprised that they didn't stress the technological skills as much as these more generic ones."

As part of the curriculum Winston created, students are:

- Building a Science Solutions Web site (http://www.shs-solutions.net/) that will include information on Greater Yellowstone businesses, recreational activities, educational opportunities, the network of about 10 Science Solutions schools in Idaho, products and services available from the class, and other information.
- Using geographical mapping software (ArcInfo and ArcView from the Environmental Systems Research Institute) to develop a state-of-the-art school bus transportation tracking and maintenance system. Once completed, the system will include virtual aerial views of all bus routes with a variety of click-of-the-mouse-options to highlight individual routes, identify each house on the route, measure distance between stops, provide medical emergency information on riders, and identify names and numbers of children at each stop.

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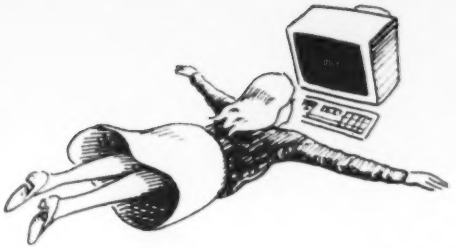
SOLUTIONS



■ Identifying and mapping wells in the Snake River aquifer.
■ Restoring cutthroat trout to rivers through a project with the Idaho Department of Fish and Game
■ Tracking the demise and restoration of wolf populations in the Yellowstone area.
■ Working with learning-disabled middle school students on a plant-cloning project.

The students' animated, three-dimensional videos (software: 3-D Studio MAX R2 from Kinetix) provide a visual tool that will enhance public understanding of complex social and political issues, says junior Josh Toy. "With the three-dimensional models we're creating, we can slice the images, show the insides, the outsides, and how everything fits together," says Toy, who mentors his classmates in the uses of software.

Winston says that the use of the sophisticated 3-D Studio software, most common in upper-level college architecture programs, is well within the grasp of high school students. In fact, he notes, the manufacturers of the software were having a difficult time making inroads at the high school level and came to Winston and his students.

"They wanted us to take it on as a project so they could show the state Department of Education that it was a wise investment for high school students," Winston says. "The state was skeptical, very skeptical."

But Winston's students now use the software routinely. "We just go in and do the tutorials, experiment," says Toy. "That's where the fun is. That's really what 3-D animation is about—learning through experience and experiments."

Toy's latest project is a video about the wind tunnel that the Idaho Department of Energy Laboratory proposes to build. Researchers would use the tunnel to study the effects of hurricanes, tornadoes, and other natural disasters on different structures. The video takes viewers inside the tunnel, where a virtual camera pans, rotates, and revolves to provide a full range of views. It shows a string of 160-foot-tall louvers that can alter wind direction and velocity and gives viewers a graphic look at the impact such changes have on a structure.

All work is done to scale, and students work with architects and engineers to ensure that their creation is an accurate portrayal of the design. Toy worked on the project throughout the summer as a member of a Science Solutions Action Team at the Idaho Energy Laboratory. Team members, who are selected through an application and screening process, work in the field and in the lab. They receive a fellowship and college credit through the Associated Western Universities —a consortium of Idaho colleges and universities. This year, Toy works on the wind tunnel project 15 hours a week for the laboratory.

Through their Science Solutions class, students also have responded to the needs of their local school district. In one recent project, students worked under tight timelines to create a new district map that met state legislative requirements. "The zones for school board elections were out of compliance," Winston says. "The populations in the zones were supposed to be within 10 percent of each other. They were not. One was more than double the population of the others. The school board tried to fix this, but couldn't."

Two students learned how to use the ArcView mapping software from a mentor at the Idaho Energy Laboratory, then developed a new map with population distributions that were within 3 percent to 4 percent of each other. "The redistricting needed and got legislative approval," Winston notes with pride.

Shelley Science Solutions students have traveled the country to showcase their skills and projects at conferences and meetings. "We get a lot of requests," Toy says. "We can pick and choose what we want to do now."

TEACHER'S FOOTNOTES

On changing roles:
"I had a choice to make. If I wanted the kids to have these sorts of opportunities, then they could wait three years for me to learn more, or I could make it available and get out of their way. Now I can spend a lot of my time encouraging and motivating kids, and getting out in the community creating links to the classrooms. Teachers must experience the changes that have taken place in the outside world in order to make their training relevant."

On sophisticated software:
"The kids are coming out of here knowing this stuff, mastering software that colleges are not even offering yet. If you give it to kids, they'll learn it. And someday, the colleges will catch up to our kids."

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Chaucer Lives

By LEE SHERMAN

PHOTO BY CAROLE ARCHER

WHITE SALMON, Washington—Imagine opening a dog-eared textbook on ancient history or classical literature. Now imagine that instead of holding only silent words and static pictures, the book is alive with voices, music, and moving images: A three-dimensional Attic amphora rotating on a marble pedestal. The prologue to Chaucer's *Canterbury Tales* narrated aloud in Middle English. A scene from King Lear captured on camera, with an excerpt from the movie soundtrack "Interview with the Vampire" playing in the background.

At Columbia High School, teacher Peter Knowles has found a way to give new life to old stories with sound, color, video, animation, and dimension. Instead of just spewing back information on exams or essays that wind up in the trash can, Knowles' sophomores display their learning in virtual (digital) museums created on the classroom's six Macintoshes (software: HyperStudio). Museum visitors can ride virtual elevators or click on icons to move through the six wings, each with its own student "curator" and theme:

- Group Membership: Ancient Civilizations
- Legacies: Classical World to Renaissance
- Living with Change: Technology
- Exploring Limits: Revolution and Exploration
- Beyond Hate: Leadership and the Holocaust
- Special Exhibits: Research, Writings, and Other Sustained Projects

Just before Christmas, the six-student teams spent a class period visiting and rating each other's museums for the first three units. As they explore from wing to wing, the visitors can see the blending and mingling of content from two "linked" classes: Knowles' world history class and Lois Yake's world literature class. On exhibit is everything from politics to poetry to pottery.

Catching the elevator to the Ancient Civilization wing, visitors to one team's museum find two overlapping circles representing the city-states of Sparta and Athens. Clicking on icons arrayed in the circles reveals comparative traits of the military, government, and other aspects of the ancient cultures. Another museum features a colorful map of the ancient world. Clicking on a civilization, such as Egypt or Sumer, visitors get a close-up map of that area. Another click brings up critical attributes—such as leadership, occupations, religion, and agriculture—of each society. Posted on another wall of the wing, an essay on literary genres explores the distinctions between the ancient storytelling traditions of legend, myth, fable, parable, folk tale, and epic.

"Wow, this is some amazing stuff! Awesome!" one student enthuses as he takes a ride on a virtual elevator to the next wing, the Classical World. There, visitors can hear a student recite the first 18 lines of *Canterbury Tales* while they scroll through the text, which appears onscreen as an illuminated manuscript. Further exploration takes visitors to a room displaying classical art—Michelangelo's *David* and Botticelli's *Birth of Venus*. When visitors click on the sculpture or the painting, up pops a descriptive paragraph on that masterpiece. The click of another icon brings up a reference list citing sources for the images, which were scanned from textbooks. Knowles stresses the importance of crediting authors, photographers, artists, and publishers whenever images or text are borrowed from books or Web sites—and getting permission to use others' images or excerpts for museums that go online.

In the third wing—still "under construction" for most teams—

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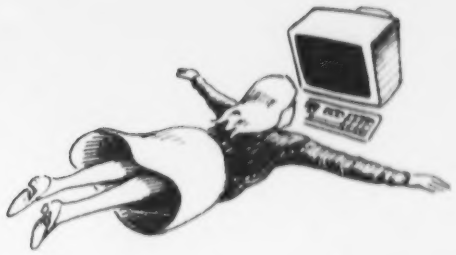

visitors see evidence of technology's role in cultural change. Displays include timelines of the Industrial Revolution, essays on Isaac Asimov's *I, Robot* (a collection of short stories that delves into the ethics and trade-offs of technological advances), and this original poem, "Ode to My Computer," by student Davy Stevenson:

My new computer
so suave, so sleek,
Has 24XCD-ROM at its peak.
A 233MHz Pentium chip,
With MMX technology,
will make you flip,
A K56 modem, the fastest yet,
To help me surf the Internet.
A built-in 100MB Zip drive,
A TV to watch MTV Live,
Bill Gates the newspaper
front-page made,
Oops, now I need to upgrade!

The museums—which account for 25 percent of students' course grade for history—are not without wit and whimsy. Some wings, in fact, are mainly showcases for hopping frogs, hovering helicopters, flying beanies with twirling whirligigs, and clever sound effects like *kerplunk!* and *boing-boing*. Says Knowles, "HyperStudio has tons of little gizmos like that." His philosophy: "You've got to let kids get that out of their system."

Besides making history and literature more visual—and therefore more tangible—for students, the museum project gives kids extra incentives to aim for excellence, Knowles says. For one thing, students draw upon their work—reports, quizzes, exercises—throughout the school year as they develop their exhibits. No longer are assignments destined for the recycling bin. The museums, Knowles says, help cement students' learning as they return to it again and again.

"We're looking at the museum as a permanent repository of work that the students are creating," says Knowles. "They're starting to care a lot more about the quality of the work they produce."

Another incentive is the audience. The museums are public places. Students can wander in and view their classmates' creative and intellectual efforts. And, to expand the visitor base exponentially, the best museums will be posted on the Web, where browsers from around the world can make virtual visits (look for the museums on Knowles' home page at http://edtech.esd112.wednet.edu/teldec/knowles/index.html). At year's end, Knowles plans to invite the community in for a "grand opening" of the virtual museums. Awards will be presented for the most outstanding exhibits. Notes Knowles, "When you increase the audience, you really do increase students' interest and effort."

In yet another community outreach, Knowles hopes to link the virtual museums to an actual museum, Maryhill Museum of Art, which graces a windswept bluff near the school in the Columbia Gorge. With Maryhill's eclectic collections that include "an incredible American Indian basketry and pottery exhibit," the museum is a rich historical and cultural resource practically on the school's doorstep.

The museum project, Knowles says, helps prepare students for 21st-century styles of information acquisition and manipulation. "If they acquire this information on Sparta and Athens, and they've manipulated it into an essay, can they also manipulate it into a visual display or into a sound bite?"

Editor's Note: Peter Knowles is a participant in the TELDEC teacher training project co-sponsored by the Northwest Regional Educational Laboratory's Technology Program and Washington's ESD 112 Educational Technology Support Center. See Page 7 for more information.

TEACHER'S FOOTNOTES

On the software:
"With HyperStudio, there's a real easy way to create 3-D animation by putting any object—say an Indian basket—on a lazy Susan and then, using a digital camera on a tripod, taking 32 pictures of the object as you turn it around. Then you animate it, and it becomes an exhibit that shows up as a graphic on the screen. When you move the cursor over the object, the cursor becomes a little hand, which the viewer can use to turn the object around onscreen. And it doesn't take that much memory."

On visual elements:
"For the comparison of Sparta and Athens required for the Ancient Civilization wing, a lot of students just took their essays (an earlier class assignment) and threw them up on the wall of the museum. That's why I require visual elements for every wing, so students don't just have four walls of writing. That becomes kind of tedious. Scrolling through text is not the best way to present or acquire that information."

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SHELF TALK

By CATHERINE PAGLIN

LAKE OSWEGO, Oregon— Cindy Kim's classroom at Westridge Elementary School has a homey, lived-in feeling. The decor includes three well-worn couches, a bookshelf filled with student favorites, round tables instead of square desks, and cubbyholes jammed with art supplies. The informal surroundings match the comfortable way her fifth- and sixth-grade students interact. This afternoon, crammed into a corner, four of them jostle each other, bickering good naturedly about whose turn it is to use the two Macintoshes and freely exchanging comments and advice.

"Kyle, do you know how to make the earth blue? Adam, do you know how to make the earth blue? Kelsey, do you know how to make the earth blue?" A problem with the usually cooperative, electronic painting tools prompts Zack to query his classmates. Kelsey offers her solution, then stares at the screen in disbelief when it doesn't work: "That should be blue!"

Kim's students are using integrated software (ClarisWorks) to make "shelf talkers"—informational tags that hang off the edge of a retail shelf under a product. In this case the products are children's books; the shelf talkers are for a local, independent book chain. The assignment combines elements of the reading, writing, and visual arts curricula, while giving students the chance to make something that serves a purpose in the world outside of school.

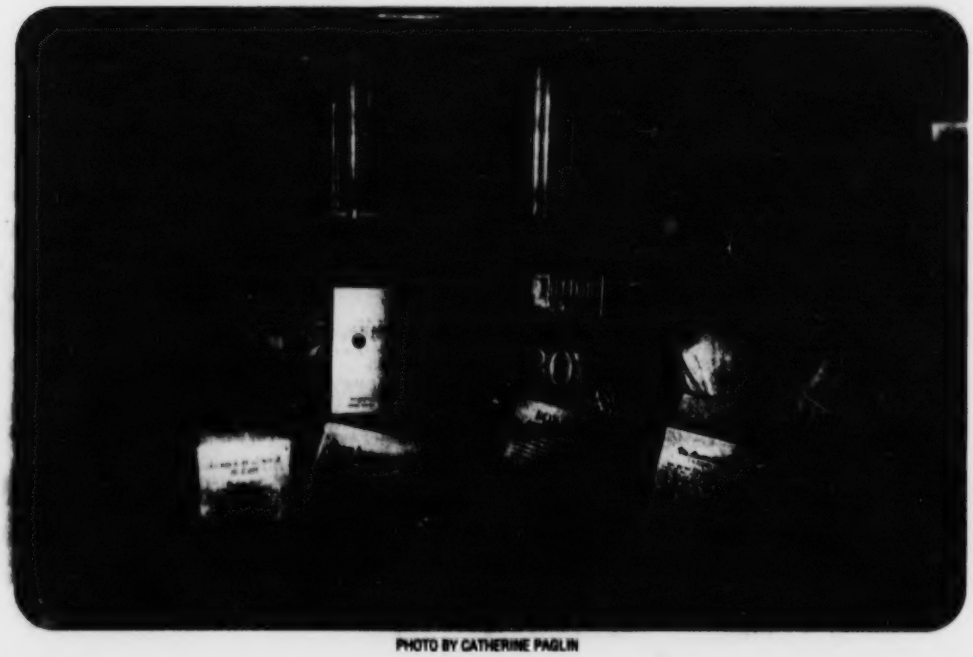

PHOTO BY CATHERINE PAGLIN

"We always try to integrate our curriculum and naturally incorporate computer technology skills into it," says Kim.

Student book choices range from popular fiction with titles like *The Voice on the Radio* and *The Face on the Milk Carton* to classics like Jules Verne's *Journey to the Center of the Earth* and Walter Farley's *The Black Stallion*. The shelf talkers include the title and author of the book, a few descriptive sentences meant to hook the reader without revealing the book's ending, an illustration, and the student's name, grade, and school. Students must write the text in the word processor. Clip art is not allowed.

Zack's shelf talker on *Journey to the Center of the Earth* reads:

If you like adventures you must read this book. Imagine you are Oliver Lindenbrook, a well known scientist. You are in the middle of the earth being sucked into a whirlpool with your band of brave explorers. On your team you have the wife of one of your colleagues, one of your students, and a Icelander named Hanz. Will they ever make it out? Or will they be doomed to live in the center of the earth FOREVER!

The book's title is in red. Behind the text floats an image of the earth. Below is Zack's computer drawing of a toothy, green dragon. The text and graphics are laid out in a column on the width of half a letter-size piece of paper cut lengthwise. When completed, the shelf talker is mounted on colored paper, laminated, and folded approximately in half (widthwise) so it can hang off the shelf in

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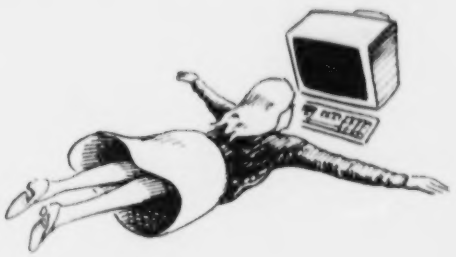

Kim's class and the one at the bookstore.

Some students have put thought into issues such as what style or color of font is most appropriate to their book. A girl writing about *The Black Stallion* uses a dark, flowing script which she feels expresses the mysteriousness of the horse. A boy writing about a book set in World War II Japan puts its title in red, matching the red suns on his illustrations of the Japanese flag.

Last year, Kim had students begin the project by hand. "I gave them a sheet of paper to work with and said, 'Write it in handwriting, do your drafting on paper,' and they had such a difficult time handwriting, knowing where to lay out, how big to write, how little to write to get all their information in. We tried it on the computer after that, and it was so much easier to edit, to work with, to include things, and even the graphics."

Working with the computer encourages the students to look to each other when they need help. "Some kids know more about computers than others," acknowledges sixth-grader Darcy.

"With one teacher and 29 students—or as your numbers increase—it's harder and harder to get to each child," says Kim. "The computer's a great place for kids to practice teaching each other, sharing with each other, problem solving. And they're real problems, and everyone's is a little bit different."

The computer-based project also creates a natural forum for students to comment on each other's work. Today, classmates in the computer corner encourage one boy to experiment with different colors for the book's title. "Why don't you try dark blue?" says one. "Why don't you just make it black?" says another.

"When you bring someone else's eye on to it, it's so much easier and faster for a student to edit right there and then—testing it," says Kim. "You can't test a different color if you've already colored it [by hand], unless you redo it and start over."

Kim structures the shelf-talker assignment with students' computer habits in mind: "We try to have them do content first, *then* go back and do all the enhancing, because their initial action is to go for the graphics and fonts, styles, and all of that stuff."

Last year her class made shelf talkers at the end of the year when students had already had lessons on many types of software.

"Last year they used skills they already had . . . so they were taking it and putting it together for the first time," she says. "This year we used it as a beginning lesson tool for painting and drawing. So you can really use it as a culminating project or use it as a project to introduce some skills."

Kim likes the fact that on the computer, students who want to explore different graphic techniques can do so, while students who don't like to take risks can undo their work as quickly as they did it. And though using the computer is required for the text portion of the assignment, she builds in additional flexibility by allowing students, if they wish, to illustrate the shelf talker by hand.

Says Kim: "Parents have different philosophies about what role the computer plays, so we do try to balance, and give students choices."

TEACHER'S FOOTNOTES

On integrated software:
"ClarisWorks includes painting, drawing, word processing, data base, and spreadsheet, and it's a great price. It gives students a lot of experience with all different types of applications. ClarisWorks seems to be something that a lot of schools are using and have readily accessible to them. For this project we use the word-processing, painting, and drawing portions."

On printing:
"I always tell them to print in black and white until we're ready for the final copy because the color cartridges are not exactly the cheapest things."

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THE HUMAN CONNECTION

By DENISE JARRETT

ANCHORAGE, Alaska— Tears are a part of fifth grade. So when Randall sits wiping his flushed cheeks while the rest of the class digs into their book bags, teacher Pam Lloyd kneels by his side. It's a matter of homework turned in late. In Lloyd's class at Kincaid Elementary School, there are consequences for breaking the rules. But there are also opportunities to set things right. A few soft-spoken words and a hand on the shoulder, and Randall is back in the action.

Like any good teacher, Lloyd strives for balance in her teaching. Discipline and fair play. Expectations and choices. At the center lies a conviction that human connections provide the foundation for teaching and learning.

With its powerful communication capabilities, the computer has become one of Lloyd's most valuable tools in facilitating these connections. But it requires balancing, too. Technology's effectiveness in the classroom, she says, is only as good as the teacher and her relationship with her students.

"The computer is a tool," says Lloyd. "The human part is what really makes the classroom. If I had a choice between the two, I could do without the computer, but I could not do without the human interaction. That's what makes the bond between teaching and learning."

When a teacher integrates technology into good instructional practices, says Lloyd, she gains a new dimension to her teaching that can help motivate and engage many of today's students.

"Kids are coming to us from such media-rich environments," she says. "Even kids from poor socioeconomic schools (in the Anchorage school district) are media-rich in their homes—Nintendo, television, radio. So, I think they learn better when they're in a classroom where they have lots of technology available to them. That way, they have different ways to present their learning. I could teach the same lesson without technology, but they probably wouldn't be able to show me their depth of understanding."

Though hers is a media-rich classroom, Lloyd strives to make the technology transparent. It nearly is. A visitor has a hard time finding the five Macintoshes, eight AlphaSmart keyboards, and two Apple Quick Take cameras. Like hidden faces in camouflage art, the computers in Lloyd's room are overshadowed by a forest of shapes and colors: wall displays and mobiles; books, books, and more books; overflowing resource tubs; and an "aqua corner" with fish tank and whale display.

Lloyd also seeks to make technology transparent in another—more important—sense. She wants her students to reach for technology as readily as reaching for a pencil. If they need to create a graph, they can do it with a spreadsheet program. If they need to research the climate of Florida, they can search the Internet, among other resources. If they need to communicate what they've learned, they can use a multimedia presentation program to present their knowledge. This is part of being technologically fluent—an increasingly necessary skill, says Lloyd.

"Information is coming at us so fast that there's no way we can know it all," she says. "The problem for kids is how to look at that information and make a judgment or decision about it: Is it good information? What do I do with this information now that I have it? So kids need to be technologically fluent, which means knowing how to use technology to get the information you need, and the best information available."

Lloyd has integrated the computer into almost every aspect of her teaching. While studying about energy, for instance, her students use the Internet to research energy sources in the United States, getting material from such Web sites as Energy Quest, created by the California Energy Commission (http://www.energy.ca.gov/education/index.html), and the National Energy Education Development Project (http://www.energyconnect.com/need/).

"I do an Internet lesson at the beginning of the year," Lloyd says. "I explain that information on the Internet is not always valid—that unlike book publishing where there are guidelines, there often aren't any editors checking what goes onto the Internet. I explain where the most reliable information can usually be found; what '.com', '.gov', and '.edu' mean. We break down what 'http://www...' means, and we talk about domains, about hypertext markup language (HTML)."

After searching the Internet, the school library, and the classroom book collection, student teams create brochures on natural resources in a region such as the Midwest or New England. They write text for their brochures using a word processing program (software: Microsoft Word) on a Macintosh computer or AlphaSmart keyboard. (AlphaSmarts are word-processing keyboards that can be used as a substitute on a short-term basis when a regular computer is unavailable. After

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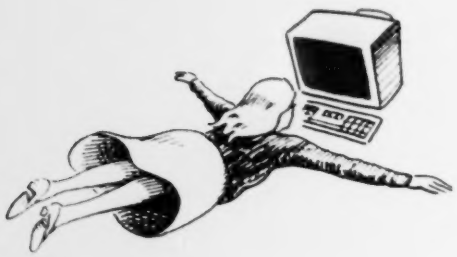

composing on the AlphaSmart, students can download their document to a regular computer.) Students illustrate their brochures by downloading maps and pictures from Web sites such as Weber Publications' *The 50 States of the United States* (http://www.scvol.com/States/) and Microsoft's *Encarta Online Schoolhouse* (http://encarta.msn.com/EncartaHome.asp). Students create graphs and charts depicting the country's energy production and consumption in a spreadsheet program (software: ClarisWorks).

Linking the energy curriculum with geography and history, Lloyd involves her students in online educational games such as the Global SchoolNet Foundation's GeoGame (http://www.gsn.org/project/gg/). Students from around the world compete to identify each other's hometowns from clues such as latitude, weather, and land and water formations.

To demonstrate what they've learned about energy, students create a multimedia presentation that they share with their parents on Computer Family Night. They begin by creating a storyboard on paper, sketching out how they want their presentation to look. Then, in HyperStudio, they create "cards" that contain text and graphics, including a photograph of themselves taken with an Apple Quick Take digital camera. Students place icons, borders, and patterns on their cards to make them visually coherent and attractive. Many include scanned images, animation, and sound. Students then group these cards in a "stack" that becomes their presentation. A few resourceful students link their stacks with other students', creating a mosaic of dozens of cards. This spring, they will place their presentations on their own Web pages.

Reflecting on how technology has helped her achieve a strong connection with her students and their parents, Lloyd offers this anecdote: "One of my students is from South Africa and every six months he and his family go back to renew their visas. The parents didn't want to pull Jeremy out of school, but they were going to be gone for a month. I asked them if they had a computer and Internet capabilities in South Africa, and they said yes. So I developed a Web page and put his assignments on it. I created vocabulary and geometry sites, a fun site, and links to other Web sites. Jeremy and I communicate by e-mail, and he talks about his homework with other students by e-mail, too. That's an example of how technology can be wonderfully effective."

TEACHER'S FOOTNOTES

On Internet safety:
"I talk to students about getting into sites that aren't appropriate. I tell them that I can find out at any time where they've been on the Internet by looking at their computer's cache and history files. I tell them that if they accidentally get onto an inappropriate site, that they should click 'stop' and come tell me. I also give them a security talk about how important it is not to give their personal information to anyone on the Internet."

On Internet searches:
"I generally do the Internet searching for students, because I know what it is I want them to visit, and I don't want them to be free-searching during their one hour of lab time. I bookmark lots of links and place them on a Web site for students to look at. When I do allow students to search, I have them use Yahooligans (http://www.yahooligans.com/), Alta Vista (http://www.altavista.digital.com), or Dogpile (http://www.dogpile.com/custom/index.html). Alta Vista is my favorite search engine because you can fine-tune your searches."

On teaching technology:
"I think my best advice is to learn about the technology you'll be teaching, just as you would if you were teaching math—you'd develop a depth of knowledge about it. Teach students basic computer skills, and then let them explore. Once they know how to use the tools, their creativity takes over and they're able to produce something that's meaningful. Have expectations, have standards, have a rubric, and assess their computer skills just as you'd assess any other area of study. Always let whomever you're teaching have the mouse in their hand."

On learning technology:
"I strongly recommend that teachers get involved with educational listservs, such as the Global SchoolNet Foundation's HILITES (http://www.gsn.org/teach/list/hilites.html) which focuses on classroom projects. It will really help teachers to integrate technology into their curriculum. Some of my other favorite educational Web sites are:

- Global SchoolNet Foundation's K12OPPS (http://www.gsn.org)
- Dr. Data (http://www.un.org/Pubs/CyberSchoolBus/menuquiz.htm)
- AskEric (http://ericir.syr.edu/)
- Kathy Schrock (http://www.capecod.net/schrockguide/)

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Funky BUTTONS

By LEE SHERMAN

PHOTO BY ROBERT MERRIMAN

HELENA, Montana— "How'd you get that?" one boy says, an edge of frustration in his voice.

"Push the funky button at the top," another student calls out from the next aisle.

Across the room, a third student crows triumphantly: "I got it! I got all three!"

"You suck," mutters the boy behind him as he continues to punch buttons on his hand-held calculator, the Texas Instruments TI-83.

At the front of the room, teacher Wendy Driscoll guides the Helena High School freshmen through a problem that blends concepts from physics, biology, algebra, and pattern analysis. As she enters numbers and functions on her pocketbook-sized TI-83, her work appears bigger than life on an overhead screen.

Students began exploring the problem a day earlier in the science lab, where they burned cereal to estimate the amount of energy (kilocalories) locked inside the grain. Now they're tackling the math, some hunched intently over their calculators, others slouched casually in their chairs, all fully engaged at 7:45 on this chilly Montana morning. They're computing the amount of time it takes a person weighing 60 kilograms to burn 100, 200, 300, 400, and 500 kilocalories when doing each of three different activities—one requiring a high amount of energy (playing basketball), one requiring a moderate amount of energy (lifting weights), and one requiring a low amount of energy (watching TV). Then, using their TI-83s, the students are entering the results to create a "scatterplot" graph showing the relative slope of each activity. The calculator/computers can generate a graph instantly with a few taps of the finger. The old way—plotting points on a piece of graph paper—is by comparison slow and laborious.

"For this particular lesson," says Driscoll, "we couldn't have covered that much territory if we were doing it by hand—plotting all those points and doing three different sets of equations. There's no way. The TI-83 allows us to investigate a lot more equations—and a lot more sophisticated equations—than we can with pencil and paper. My seniors are doing some really sophisticated polynomials that they probably wouldn't be doing without this technology."

The problem that engrosses the freshmen is from a module called "Yesterday's Food Is Walking and Talking Today"—part of a technology-intense mathematics curriculum developed and field-tested by teachers in Montana. A five-year project launched in 1990 and funded by the National Science Foundation, SIMMS (the Systemic Initiative for Montana Mathematics and Science) had several major goals:

- Incorporate technology into all facets and at all levels of the math curriculum
- Integrate high school mathematics with other disciplines, including science, social studies, and language arts
- Design a curriculum that reaches all students, both college-preparatory and non-college bound
- Draw more females and American Indians into math and science

The SIMMS *Integrated Mathematics* curriculum (published by Simon and Schuster) from which the Helena students are working presents math problems in real-world contexts. Instead of just "solving for X," Driscoll says, kids get a chance to predict, explore, interpret, evaluate. They get a chance to think like geologists, sociologists, engineers, architects. Working in pairs or in teams, they use real data to solve problems

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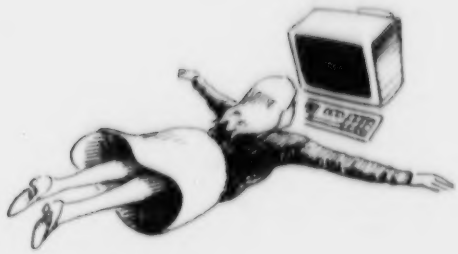

encountered in the home, the workplace, the community, and the environment.

"What you don't hear in a SIMMS classroom is, 'Where are we gonna use this stuff?'" reports Driscoll, who worked as a computer program analyst for oil and gas with the Montana Department of Natural Resources and Conservation before returning to the classroom several years ago. Now chair of the Helena High math department, Driscoll spent four summers in Bozeman writing modules for the SIMMS curriculum. The Level I (freshman) module in which Driscoll's students are working presents these kinds of problems:

- During a unit on volume, Driscoll's students will use data from the infamous Exxon Valdez oil spill of 1989 to calculate, among other things, the volume and surface area of the spill. Students are encouraged to search the Internet to find data on other disastrous spills.
- After creating a kaleidoscope with hinged mirrors, students explore mathematical properties of a variety of polygons (triangles, quadrilaterals, pentagons, etcetera). Students then use their understanding to explore such real-world problems as laying pipe for an oil pipeline, building a trail, and predicting the path of radio waves and laser beams.
- A unit titled "So You Want to Buy a Car" looks at a number of variables in car design, including the relationship between highway fuel economy and weight. In one problem, students create scatterplots of data from various car models, then use the graphs to estimate how far each car can travel in a given number of seconds.

Electronics play a role in virtually all the SIMMS modules. "The technology serves as an investigating tool," says Driscoll.

Throughout the six levels of the curriculum, students use the graphing calculator, which has built-in software and can be networked so students can share data. Higher-level students also use another Texas Instruments device, the Calculator-Based Laboratory (CBL), which uses a probe or sensor to collect scientific data (temperature, motion, heart rate, pH, light, sound, and so on) in the classroom. One unit for juniors involves calculating the rate of change in the motion of a soccer ball rolling down a ramp. The CBL picks up the ball's motion. The data flows into the graphing calculator, to which the CBL is linked, to produce an instant graph.

Personal computers are used, too, for spreadsheets, geometry construction, statistics, symbol manipulation, and word processing. But the hand-held graphing calculators have one obvious advantage over PCs: Each student can have his or her own piece of equipment.

"On computers, it's four students to one piece of equipment," says Dave Campbell, a Helena math teacher who works closely with Driscoll in delivering the SIMMS curriculum. And, he notes, the hand-held calculators can be linked to the school's computer network to produce printouts of graphs and other data.

The best thing about SIMMS, Campbell and Driscoll report, is that through open-ended exploration of math concepts, students can attack problems with greater depth—and with more daring. "The teacher plays much less of a role in SIMMS than in a traditional math class, especially at the higher levels," says Driscoll. "There are a lot of independent learners in SIMMS. And they're really good risk-takers. But weaning them away from being spoon-fed is not easy."

TEACHER'S FOOTNOTES

On integrated math:
"It seems to work well with some kids who have never been successful before. At the same time, there are some very bright students in the class who prefer it because it's more meaningful to see (math concepts) in context. But it has its detractors. There are some people who feel that it isn't really math because it isn't what they had when they were growing up. They want more drill and kill."

On costs:
"The graphing calculators cost $88. Most kids buy their own. For students who can't afford them, the principal has a fund that will pay for half. Once in a while at an open house, a parent will say something about the cost—that it's an outrageous expense. We point out that a pair of basketball shoes costs $110 and only lasts for a season. Students will use the same calculator all through high school and on into college."

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Charlyne's Web

By TONY KNEIDEK

MACKAY, Idaho—

A gaggle of fifth-graders races into Charlyne Kaulukukui's classroom. Through another door, a batch of kindergartners hustles to the six computers stationed at the room's far end, where the younger and older students pair up. As the little kids tell stories based on pictures they had drawn earlier, the big kids record the tales on the computers. Calling upon their more advanced writing skills, the older mentors add shape and structure to the kindergartners' storytelling.

Kaulukukui—or Ms. K, as she is known in this town of 500—floats among the pairs of students, listening in, offering guidance and providing support. At one computer, Erin keyboards her sister Katie's story, coaxing more information from her and supplying punctuation as the tale about a snowy Valentine's Day unwinds. Katie steps to the keyboard to sign her name to her creation before printing it. Then she reads her story aloud with Erin's help. The story is stored on a disk along with other projects that together form an electronic portfolio that will follow Katie through her years at Mackay Elementary School.

Ms. K is pioneering new ways for her 15 fifth-graders to learn and grow through the use of computers and other technologies in the classroom. Cross-grade tutoring, online research, and international e-mail are some of the ways Ms. K employs technology as an instructional tool—a tool she weaves throughout her language arts, science, geography, and reading curricula. "At the elementary level, we teach 10 to 12 curricula a week," she says. "I hear teachers ask, 'How can we add more?' How? You integrate it. When I teach social studies, I bring in history, literature, writing, and now, technology. It becomes a web with social studies at the center."

Projects range from economics to English. For example:

■ This year, Ms. K has developed an economics project in which her students "play" the stock market, watching their investments rise and fall, moving money around, and determining when to buy and sell. Students access a daily financial report—both the morning call and the closing bell—through Infobeat (http://www.infobeat.com/).

■ A Malaysian e-mail friend of Ms. K corresponds with the students and tells them about the economy in Asia and its influences on the world market. "Children need to be aware of cultural diversity," says Ms. K, who is a native of Honolulu. "They need to see and understand other people, the places they live, their countries, and to have an appreciation for other cultures."

■ Four young women in Denmark are learning how to write proper English with the help of Ms. K's fifth-graders. One Danish girl recently wrote in part: "Hallo Ms. K!! My name is Anette. I'm 14 years old. I have birthday September the 30th. I have three jobs . . . My mother is a hause wife she is 32 years old . . . and her name is Anni, and my father work in our capital (Copenhagen) he is 36 years old and he name is Jens." The Idaho fifth-graders edit the letters, rewrite portions of them, and send them back. The letters are projected on a TV monitor, and the students review them together, noting grammatical errors, problems with punctuation, and mistakes in verb tense. Ms. K linked up with the Danish students through their teacher, whom she met in an Internet "chat room" where people from around the world converse online. (The address for the "Net meeting" where the two women connected is http://www.microsoft.com/netmeeting/.)

"The wonderful thing about technology is that it brings the world to our classroom," says Ms. K. "My goal is to prepare my children for the world—to let them know that they can have an education, see the world, and always come back home again."

Besides corresponding with the Danish youths, Ms. K's students have e-mail relationships with students in Italy, France, and China.

"I'm learning a lot about other people and what's going on in the world," says fifth-grader Ellen. "You can see things, hear things, talk to people, and get places. And I can do it all by myself."

In another classroom, sixth-graders Jessica and Amanda huddle over their computer. After clicking on Yahoo! (a popular tool for searching the World Wide Web), they type in the word "armadillo," and wait a few seconds until a list pops up offering a variety of Web sites. "Most of the [illegible] with [illegible] observ[illegible] lot of [illegible]."

Today, the girls are looking for pictures of armadillos, so they return to Yahoo! and narrow their search, typing in "armadillo picture." A site pops up with lots of scanned photos of the armor-clad creatures common in the Southwest. Jessica and Amanda click and copy the photos, then import them to Microsoft PowerPoint, a program for planning multimedia presentations, useful to everyone

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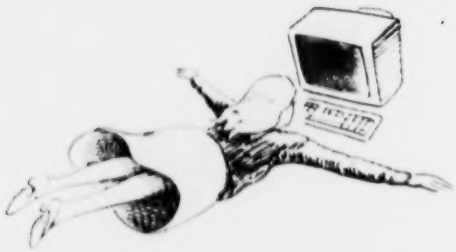

from corporate CEOs to sixth-grade students.

In PowerPoint, Amanda and Jessica have combined text and photos for a report they will present to their classmates. The presentation software will be wired to a 21-inch TV monitor that allows the girls to project visual images while they give their oral report.

Sixth-grade teacher Cindy Kimball says technology addresses the working and learning styles of more students, and keeps students engaged in their learning. "We require that all our sixth-graders do a PowerPoint presentation," she says. "This is an exciting way for them to transfer their knowledge, and they're using a variety of communication skills. These reports are a way for them to reach everyone in the classroom."

When a new project is introduced, Kimball works with five or six students, helping them to locate appropriate Internet sites, developing a list of key access words, and guiding them through the maze of Web sites. Those six students then share the information with others, acting as coaches in the early stages of project development.

Students, Kimball cautions, must be monitored when they're on the information highway. Navigating the Internet can lead to sites with sexually explicit photos, language, or other inappropriate material. "I don't let them do anything on the Internet without me there," she says. "There are a lot of sites that are not appropriate. We have to be real careful—go step-by-step and preview where we want the kids to go."

This year, fifth- and sixth-grade teachers are participating in the Idaho State University Mentor Program for teachers. (Second- and third-grade teachers began the two-year program last year.) The program, paid for through a grant from the university, provides methods of curriculum integration for word processing, spreadsheets, electronic presentations, and Internet use. Participants then train colleagues in their school and model technology integration. As a result, teacher collaboration has increased along with the implementation of technology-based teaching.

Still, Ms. K says, computers have limitations in the education of children.

"I like computers," she says. "I find them exciting, but they cannot replace teachers and books. They cannot say to a student, 'It's OK, you're having a bad day.' They cannot put a Band-Aid on a child's scraped knee. They cannot touch human lives in truly human ways."

TEACHER'S FOOTNOTES

On sites and software:

Ms. K has several sites bookmarked for her students' convenience, and also has her favorites written on the board just above the computers. They include:

- Security Industry Association sponsors the SMG 2000 stock market game, a 10-week simulation of Wall Street trading that provides a framework for teaching students in grades four through 12 about the American economic system. It is designed for classroom use to increase understanding of the stock market, the costs and benefits involved in economic decision-making, the sources and uses of capital, and other related economic concepts. Angela Garcia is the Stock Market Game Coordinator for the Idaho Council on Economic Education (agarcia@cobtac.idbsu.edu).
- Yahooligans (www.yahooligans.com) is a kid-friendly site with snappy graphics and a main menu that includes links such as Around the World (countries, politics, history); Art Soup (museums, dramas, dance); Computers and Games (shareware, software); School Bell (clubs, homework help); Science and Oddities (space, animals, robots); Sports and Recreation (scores, hobbies, trivia); Entertainment (TV, movies, music); and The Scoop (comics, newspapers, current events).
- USA Today (http://www.usatoday.com) is the daily newspaper online.
- National Geographic (http://www.nationalgeographic.com/contents/) includes articles and photos appearing in the highly respected magazine that looks at global issues and cultures from around the world.

On overcoming fear: "I started with an old Apple computer and stayed there even after we began shifting to faster, more powerful computers. I had become comfortable and reluctant to change. I was secure. Now my security is in adventure—in exploring and looking for new sites and new applications. This has opened up my thinking and my world, too."

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CONQUERING THE COMPUTER

A PRIMER FOR THE RELUCTANT, THE FEARFUL, AND THE BEFUDDLED

BY MELISSA STEINEGER

Illustration: KENNY HIGDON

A lot of teachers know they should be using the computer more in their classrooms, but they don't know where to start. Or they're uncertain about how to blend technology into their lesson plans. Some have made a stab, but have given up when technical glitches or mixed results have stanched their enthusiasm. Others are afraid. For teachers who earned their degrees before computers became commonplace, the technology can still seem foreign and forbidding.

If you fall into one of these categories, this basic introduction may provide some guidance. It gives guidelines for selecting educational software. For the novice Internet user, it offers straightforward, jargon-free explanations of such technological mysteries as search engines and listservs. And it reveals the recommendations of Northwest educators, who have shared their favorite online resources and educational applications.

To start, remember two simple rules:

Rule One: Be patient; allow for a learning curve. Taming the computer can seem overwhelming when viewed as a whole, but by breaking

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the subject into small pieces, persevering, and being patient, you will succeed. An insight to keep in mind: Even experienced computer users get frustrated; the difference is they know frustration is just par for the course.

Rule Two: Begin using the technology in nonthreatening arenas. Start by writing parent letters on the computer. Do lesson plans. Keep grades. As your skills increase, you can begin bringing this tool into the classroom. Don't be surprised if some students exceed your proficiency. Draw upon their expertise. Call on them as in-class experts. Ask them to serve as coaches to kids who may need extra help. Remember, they still need your guidance to understand and use the content.

If your computer is barely out of the box, start slowly. Seek guidance from a colleague, a class, or a consultant. The key is to plunge in. In all likelihood, even the most techno-reticent will come to love the computer for the educational doors it can open. Remember, there's no single right way to begin or one best way to use a computer in a classroom. But that first step must be taken.

SELECTING SOFTWARE

One of the first problems facing the computer-using teacher is choosing appropriate classroom software. Educational software (and software that calls itself educational) is everywhere. More than 2,000 titles are released annually. Much of this software is useful; some of it is awful. And none of it replaces the teacher. One study found that unsupervised students began using a software program on the Oregon Trail as if it were a computer game—ignoring problem-solving opportunities in a race to see who could end the simulation first. In other studies, students used trial-and-error strategies instead of calculations to solve math problems. In yet another study, students ran software for the sound effects instead of focusing on the content.

In other words, kids will be kids. They need guidance to stay on an educational path.

There are many types of software. Some software develops rote memory or mechanical responses—skills required for arithmetic or sight word recognition. In these "drill and skill" programs, higher-order thinking skills are seldom required.

Software that supports discovery-based teaching methods encourages active intellectual involvement. With this type of program, what occurs on the screen often is determined by the user rather than the software developer. The interaction between learner and computer usually allows many acceptable responses. In other words, growth is open-ended.

To pick through the maze of software, it is helpful to work through a selection process similar to that used for choosing any resource to be added to the curriculum. Start by revisiting curriculum goals and standards. Hunt for software that will help students meet those goals and standards.

Set some basic guidelines for the software: its user friendliness, the level of student interaction, and the fit with curriculum requirements. Ask questions such as:

- Does the software involve problem solving or interaction between the students in a cooperative/collaborative mode of learning?
- Are leading characters diverse across sexes and races?
- Does the software perpetuate stereotypes or prejudices?
- Are the educational goals precisely defined by the software developers?
- Does the software vendor provide any instruction about how the software can be used in class and at home so that the best results can be expected?
- Does the software encourage reaching these goals by penalizing various misuses or providing guidance toward reaching the goals?
- Does the software discourage trial-and-error type behavior while favoring decisions resulting from analytical thinking?
- Are the special effects overwhelming the objectives of the software?
- Will the program fit the curriculum or will the curriculum have to be adapted to fit the program? (Some software has its own scope and sequence, and the teacher must adapt the classroom curriculum to match the computer curriculum.)
- Is the program theme-based or skills-based?

With a basic idea of what qualities you need from the software, do a broad survey to identify promising programs. Look through catalogs such as Sunburst or Learning Services for basic descriptions. Check reviews in educational technology magazines such as *Electronic Learning* and *Learning and Leading with Technology*. Read the reviews published in professional journals.

The Internet offers a lot of options (see the next section for guidance on using the Internet). Visit Web sites that provide links to sources of reviews, such as the Northwest Educational Technology Consortium's "Software Evaluation" page (http://www.netc.org/software/other.html) or the Children's Software Revue (http://www2.childrenssoftware.com/childrenssoftware/). Amy Derby, resource librarian for the consortium, operated by the Northwest Regional Educational Laboratory, recommends another "excellent" resource: the Educational Software Selector (http://www.epie.org/), a database containing descriptions

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34 **Chuck Wahle,** technical coordinator at Washington's Ellensburg School District, teaches "the wonders of interactive multimedia production, 3-D graphic rendering, and animation" to sixth-, seventh-, and eighth-graders at Morgan Middle School. You can see some examples of his efforts at http://www.esd105.wednet.edu/Ellensburg/eburg_15.html.

Says Wahle, "Don't bring in technology in the hope that it will make a curriculum come alive for students. If the curriculum is not alive for them in the first place, adding technology to the mix will simply mask the problems for a short time. Use technology to augment a good curriculum and to bring in new, otherwise-impossible experiences."

One of Wahle's top technology picks: Virtual Globe software by Microsoft. Virtual Globe is an "amazing" CD-ROM atlas, says Wahle. "I have yet to find a place in the world that has not shown up in the Globe. Beyond normal atlas areas, it has cultural information in videos and sound. Graphing can be done interactively. The planet can be displayed in several modes from geographical to satellite views during night and day. The database behind it is one of the largest authoritative collections I have ever seen."

One caveat: Virtual Globe only runs on computers with Windows 95 software. Wahle notes that teachers can preview some of Virtual Globe's capabilities at http://encarta.msn.com/evg98/evghome.asp.

and impartial reviews of thousands of currently published educational software programs. Still another option is to post queries on newsgroups or mailing lists (see the discussion on "Online Forums" below).

There is no substitute for experience. Try to interview someone who's using the software you're considering (for starters, send an e-mail query to staff members in your school or district). If you find someone who's using it, visit his classroom and observe the software in action. Ask what he likes and dislikes about the program. In addition, many school districts, universities, and education service districts have software libraries and trained staff to help with the selection of appropriate software.

Even better, observe students as they interact with the program. That will be your best indication of whether the program serves your instructional objectives. Some software publishers allow you a free preview of an entire program. Others will provide a demo disk. Still others require you to buy the software, but will allow you to return it within a specified time limit. Or you may be able to borrow a program from another teacher to review.

Try to preview all programs that appear to meet your selection criteria before you commit to them. As a general rule, if there's no way to preview the software with your own students, it's best to avoid that software.

A few technical considerations: Make sure the software being considered will operate on your hardware system. If your computer is networked with others in the school, make sure the software will operate on networked systems. Some additional, technical things to ask when considering new software: Is the program upgraded yearly? Are free upgrades given? How much training comes with the program? What kind of support from the manufacturer is available? Is there a telephone hotline number for help?

Once you've answered all these questions and found a great software program, post it for your mailing list or newsgroup so others can benefit from your experience.

THE INTERNET

The Internet can provide access to a wealth of information for both teachers and students. Without leaving the classroom, you can retrieve information on almost any topic. You can work with colleagues and subject specialists. You can explore ideas.

First, a bit of history. The Internet—now frequently abbreviated to the "Net"—started in the 1960s as a project between the U.S. Department of Defense and several universities conducting military research. The project aimed at developing a system of communication that could resist "interruptions caused by enemy attacks." The four California and Utah universities demonstrated the reliability of "packet-switched" networks. Instead of communicating directly and sequentially from point A to point B like telephones, these computers broke the information into small packets and sent them along a spider's web of telephone lines. If line 1 was too busy for any reason, the computers would automatically switch the next packet of information to line 2 or 3 or 4, and so on. The receiving computer then reassembled the various packets in the proper order, making a complete and coherent message. So the Internet —or interconnected network— was born.

The Net today offers several basic communication and information avenues:

- Electronic mail (e-mail) offers the chance to send a note to anyone anywhere in the world in an instant. It's much faster than "snail mail"—mail sent through the post office or express delivery services.
- Forums of various types (mailing lists, newsgroups) allow people to communicate with like-minded folk on specific topics, such as school projects, curriculum, or teaching strategies.
- The World Wide Web—usually shortened to the "Web"—is a subset of the Net. The Web allows online information to be enlivened by sound, graphics, even animation. Resources on the Web are typically linked to other resources, which in turn are linked to still more resources. Many classroom

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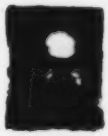

activities are likely to be on the Web. Web sites are filled with everything from bonafide research documents to personal ramblings.

The Internet—which provides access to a vast repository of information and near-infinite linkages between people and places worldwide—offers a storehouse of riches for students and teachers. Nick Cabot, a science teacher at Nathan Hale High School in Seattle, sums it up this way: "The power of computer technology in general and the Web in particular is at least four-part. First is interactivity. Variables can be manipulated and the results viewed immediately. Second is access to real-time data. All kinds of remote sensing data such as weather, astronomy, earthquakes, and ocean temperatures, to name a few, are available to anyone with a Web connection. Third is worldwide e-mail contact with scientists, engineers, other classrooms, and science Web sites. Finally, the Web is a powerful research tool providing quick access to original and archived research in all disciplines and from all over the world."

The boon—and boondoggle—of the Web is that it is massive and unregulated chaos. Anyone can put anything on it. There are no rules, there are no universal structures, and protocols (defined in *NetLearning* as "a definition of how computers will act when talking to each other") are only beginning to emerge. It's kind of like a worldwide come-as-you-are party, where everyone's invited. Some guests bring information or opinions to share with other guests, who mingle, browse, and listen. Instead of talking, though, each "speaker" displays his stuff on a Web site, whether it be scientific data, literary masterpieces, car-repair tips, or recent alien sightings.

Currently there are millions of Web sites, and more are added every day. Fortunately, there are tools to help you cut through the chatter. Using one of these tools is the most efficient way of pinpointing information in the chaos of the Web. You have your choice of tools, including Web directories, search engines, meta-search engines, Web casting services, and Web channels.

Let's look at two basic types: directories and search engines.

Directories are organized like the Yellow Pages. Information is divided into broad categories, such as "education," "arts," and "business and economy." Directory staff review Web sites and assign them to categories. You generally look things up by finding a category you want and then browsing to see if it contains anything pertinent to your topic. Yahoo! (http://www.yahoo.com) is one of the most popular directories.

A search engine creates a Web index like the one at the back of a book. You search for a word or topic, say, **kindergarten**. The engine scans its index to find matches for your search query. One popular search engine, Alta Vista (http://www.altavista.digital.com), scans through a whopping 30 million Web sites. Be aware that search engines are in constant flux. The specific sites searched by a search engine may change every few days. You can undertake a search one week and get different results for the identical search the next week.

Directories differ from search engines in coverage of Web sites. Search engines have the broadest coverage because they have immense indexes of words used in Web sites. Directories are more narrow because they contain only Web sites selected for their particular categories. Each has advantages and disadvantages. With directories, you needn't narrow down your topic right away, but instead can browse under a broad category. Just turn to the "education" category and look for **programs**. If the directory is searchable, create a query for **educational programs** and the directory will match your query to the appropriate categories.

The index of a search engine contains many more entries, but you have to be more selective about what you ask it to search for. Search engines are literal. If, for instance, you want to find educational programs and type **program** into the search box, the search tool will find not only educational programs but also computer programs, theater programs, and anything else that contains the word **program**.

Even typing **educational programs** might not help.

Nick Cabot, a science teacher at Nathan Hale High School in the Seattle School District, says: "For me, the technology must be able to do something I can't. I'm not interested in an electronic textbook." Cabot and his students will become scientists on a NASA lunar mission that launched in January—an opportunity he learned about on the Web.

Cabot's recommendations include:

- NASA listservs, which he finds timely and informative. Check out the NASA Web site (http://ita.ivv.nasa.gov) for listservs and for much more information.
- The Hale High School's Web site (http://hale.ssd.k12.wa.us).
- A great page for science teachers at http://www.sdsc.edu/Education/K-12_Resources.
- The Athena Web site (http://athena.wednet.edu), which Cabot says is a great science site with lots of prepared curricula and project ideas. "Athena takes advantage of the capability of the medium better than any other site I know," he says.
- Some physics education software he recommends includes Graphs & Tracks, Vernier Software, Interactive Physics, Cartoon Guide to Physics, and World-in-Motion (video capture and analysis software).
- For software relating to Mars, he recommends Mars Explorer, Mars Navigator, and Marsbook.
- Good software on meteorology includes Weather Disaster, Weather Workstation, and Everything Weather.

A bit of wisdom this experienced Web user passes along: "It takes lots of trial and error, word of mouth, and hours on the computer surfing (exploring) and checking things out."

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36 **Barbara Ridgway,** technology manager for Montana's Helena School District, says teachers make extensive use of the Internet "because they see quality applications that support their instruction and curriculum." Students in one class collect daily weather data and then chart and analyze weather information from around the world. Another teacher took her students on a virtual tour of the Bronx Zoo while reading a story about the zoo in a language-arts text. High school French students found native speakers for e-mail exchanges. And a science class makes virtual visits to NASA during a unit on astronomy.

Ridgway recommends the following sites to help teachers learn on their own to use the Net and computers in their classrooms:

- Mining the Internet (http://trs.ed.uiuc.edu/Mining/Overview.html) and the Thornburg Center (http://www.tcpd.org/)

Ridgway recommends finding curriculum materials online at the following sites:

- Internet Public Library (http://ipl.sils.umich.edu/), the Jason Project (http://www.jason.org/front.html), and Jerome & Deborah's Big Page of Internet Projects & Educational Technology (http://www.mts.net/~jgreenco/internet.html)
- She turns to CD-ROMs for School Libraries (http://www.libertynet.org/~lion/cd-rom.html) for help picking good educational software.
- For professional interaction online, Ridgway recommends the Teacher Contact Database (http://www.classroomconnect.com/classroom/teachcontact/).

because while the index would retrieve Web sites with those two words, they would not necessarily appear in conjunction with each other. However, every index has a way to specify multiple-word combinations. It might tell you to enclose the words in quotation marks, like this: **"educational programs."** Or it might tell you to click on a choice such as "search as a phrase."

But remember, there are no rules on the Web. Each index is different. To discover the specific way a particular index works, look at the search instructions. Alta Vista includes its instructions under the heading "help," located beneath the box in which you enter your topic to be searched. Click on the word "help," and instructions will appear.

As search tools are improved, the distinctions between directories and indexes are fading. Yahoo! now even routinely scans Alta Vista to find a search term, and Alta Vista has categories to help focus your search.

One bit of advice: Because of the enormity of the Web, no search tool will scan every Web site for your topic. To uncover more information, it's best to use different types of tools and more than one tool of each type whenever you search.

An example at this point might help. Say you want to find information about the Holocaust. After starting your "Web browser" software (the software that gives you access to the Web; Netscape Navigator and Microsoft Internet Explorer are the two biggies), go to the address box (usually near the top of the screen; it may be blank or already have an address entered, usually starting with http://www). Erase what's there and type in http://www.yahoo.com. When the Yahoo! site appears, type **Holocaust** in the search box and click the search button.

Yahoo! will reveal the categories where the word Holocaust appears—"arts," "society and culture," and "business and economy." Yahoo! also displays the Web sites where it found Holocaust (remember, this will change periodically, as Yahoo updates its information every few days or so). During a recent search, Yahoo found 160 Web sites with the word Holocaust. The first listing was for a site dedicated to the 400th anniversary of the Kirishtan Holocaust (the killing of nearly 1 million Japanese Christians over a 250-year period beginning in the late 16th century). The next listing was for classes on the Holocaust taught at colleges around the nation. The third listing was the United States Holocaust Memorial Museum. Clicking on that listing took the viewer to the museum's site, which offers photo archives, history, and more.

A search by Alta Vista (http://www.altavista.digital.com) turned up more than 29,000 Web sites with "Holocaust," rank-ordered based on the site's first 100 words and other criteria. Among the sites it found were the Holocaust Awareness Project (a site created by an 11-year-old New Jersey boy) and an eyewitness account of Holocaust survivors arriving in Sweden in 1945.

As you learn to explore the Net, it may help to experiment with search tools to find information of personal interest. Search for information on your hobbies. Visit virtual vacation spots. One advantage of this type of cruising is that as you explore, many examples of intriguing school projects or educational uses will crop up. And remember that dead ends, glitches, and pure frustration happen to everyone all the time. If they're not happening, try harder!

One note: Net users frequently get error messages that say the desired site can't be found. There are several reasons for this. There may be a typo. Check the spelling in the address box; a common mistake is to type the letter "o" for the number zero or vice versa. The site may be busy, meaning it's there, but has no room for more visitors; try again later. Or the site may have moved. Sometimes sites will leave a forwarding address.

ONLINE TRAINING

OK, so your cyber-journey has been launched. You're spending time exploring the Net. Now, where to get advanced training and answers to the questions piling up in your mind? There are many avenues

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for learning to use the Internet. You can take classes, sign up for an inservice training, go to the public library, find a knowledgeable colleague, or search the Internet for training opportunities.

Computer stores and community colleges are good places to find classes and support groups. Don't be intimidated about being a beginner —there's nothing a computer aficionado likes better than delivering information, often more than you can absorb all at once. Be prepared to gently slow her down once she launches into informational orbit.

Also, at the first few meetings, you may feel as if you've landed in a country where you don't speak the language. Computer lingo is wondrously strange and is tossed off by aficionados with abandon. (Check out these esoteric terms: multi-user dungeon, hypertext transfer protocol, Ethernet, graphical interchange format.) But in a shorter time than you would imagine, you will notice the vocabulary slipping into your own conversations.

The Net can provide information about using itself and other technology. But be warned: "Going online can be a difficult way to learn if you're not comfortable with the technology," says Amy Derby of the Laboratory's Technology Center. If you decide to look for online training or support, one easy way to begin is to find a Web site dedicated to educators and begin reading. Many sites have how-to articles, real-life success stories, and other useful content. Often, sites and articles will have links to other sites and other articles. When a word or phrase is underlined or appears in a color different from that of the rest of the text, double click on that word and a related article or Web site will appear. To get back to the previous site, look for the back arrow on the toolbar (the row of symbols) at the top of your computer screen.

Kathy Schrock's Guide for Educators (http://www.capecod.net/schrockguide/) is one site recommended by many educators as a good introduction to all that's available on the Net. Schrock offers a list of sites useful for enhancing curriculum and teachers' professional growth. It's updated daily to keep up with the ballooning number of new Web sites.

At Montana's Helena School District, teachers have found classes and training resources through sites such as Microsoft Training Choices (http://www.microsoft.com/train_cert/train/) and Electronic Learning Just for Educators—Your Own Web Site (http://place.scholastic.com/EL/guide/index.htm). You can also find links, directories, and search engines, as well as basic strategies and tips for using the Internet on the Northwest Educational Technology Consortium's Web site (http://www.netc.org/presentations/basics.html).

ONLINE FORUMS

Another good way to learn online is to use the Internet to talk to other educators. Sharing information, success stories, and the inevitable horror stories can help combat the seclusion of teachers trapped in a "cells and bells" environment or the professional isolation of educators in remote areas.

In addition to e-mail, there are three basic types of person-to-person communication on the Net: mailing lists (also called listservs), newsgroups (also called usenet groups), and chat rooms.

A mailing list uses e-mail as a way for a group of people to communicate on a topic of interest to them all. Educators might join a mailing list dedicated to K-12 funding, middle school science curriculum, preschool development, or just about any topic imaginable. Mailing lists are sort of like a running conversation. Someone "pens" a few thoughts and sends them to the mailing list's e-mail address. The list in turn sends the message to the e-mail addresses of everyone who has subscribed to the list. Someone else responds to the comments, using the same process, and the conversation is up and running.

There is little uniform procedure for any of this, so mailing lists each operate somewhat differently. Some are informal and fly off into outer space, topicwise.

Jane Krauss uses the Internet creatively with her fourth- and fifth-graders at Harris Elementary School in Oregon's Eugene School District. For example, Krauss developed a Web site for her students to use during a unit on salmon (http://www.4j.lane.edu/WebSites/Harris/Salmon/salmon%20project/). "It pretty much stands alone," she says, "and a lot of other teachers in the district have used it."

Krauss is putting together her own Web site (http://www.4j.lane.edu/Personal/K/Krauss/Krauss.html), where she lists her favorite mailing lists and sites. Among Krauss' recommendations are:

- A listserv called Network Nuggets (to subscribe, send an e-mail to http://www.etc.bc.ca/lists/nuggets/home.html) for its daily review of a new educational Web site.
- Web 66 (http://web66.coled.umn.edu/) as an introduction to the Web for newcomers.
- Two software programs, Dinopark Tycoon and Oregon Trail, seem to "endlessly captivate" her students, she says.
- Krauss uses curriculum available at the Best in Kids Lit site (http://www.acs.ucalgary.ca/~dkbrown/index.html).
- She also taps into AskEric, an enormous resource site, at http://ericir.syr.edu/.
- Classroom Connect (http://www.classroom.net/classroom/edulinks.html) is another Web site she visits frequently.

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38 **Janet Thomson,** a consultant who was a teacher and administrator for 26 years in Montana's Great Falls School District, says: "The biggest danger I see in teachers using the Net is that searching can be so time-consuming that the teacher gives up and goes back to the way he or she has always done things. This sends a big message to kids."

Some Web sites she recommends to help teachers reduce the time they spend searching for education-related topics include:

- American Educational Research Association (http://aera.net/sigs/) which has more than 30 years of education research indexed.
- The Eric digest site (http://www.ed.gov/databases/ERIC_Digests/index/)
- Mamma (http://www.mamma.com) a site that bills itself as the "mother" of all search tools.

Thomson has compiled more than 2,000 annotated Web sites that help classroom teachers find activities, lesson plans, and listservs into *Net Returns*, one of three self-published Internet guides available for $55 each from Thomson Consultation Services, 2724 Del Mar, Great Falls, Montana 59404; (406) 453-6242; <janth@imtco.net>.

Others are relatively formal. Once you become a member, try reading the incoming e-mail for a week or so before actually sending in a comment. That way, you'll have a better feel for the tone and inflections of that particular group of people.

Mailing lists have two e-mail addresses: the address to which you send comments and the address to which you send a request to be added to the mailing list. Mailing lists can be maintained by actual humans or by automatic software programs. For mailing lists maintained by humans, the add/drop address is usually the same address for comments, plus the word "request" added just before the "@" symbol. Hypothetically, this would be: request@teachers.org. To join a mailing list, simply find one of interest (see suggestions in the margins) and send an e-mail to the manager asking to be put on the list. If the mailing list is run by a person, it may take some time for a response.

If the mailing list is maintained automatically, subscribing is different, but equally easy. Most automatic mailing lists are maintained by software called LISTSERV or software called Majordomo. Clear and concise directions for participating in the list and for removing yourself from the list will be sent to you when you join the list. Says Derby: "Usually, the information that describes the list and excites your interest tells how to subscribe. This information may be found in a magazine, sent by a friend, or available online at a Web site."

Many mailing lists are monitored by a moderator, who screens comments to ensure that they are relevant or fit whatever criteria the mailing list may have. While this sounds like censorship—and it may be—it also cuts down on the number of off-track comments sent out to multitudes.

For professional interaction online, Barbara Ridgway, district technology manager for Montana's Helena School District, recommends the Teacher Contact Database (http://www.classroomconnect.com/classroom/teachcontact/) as well as a number of other listservs teachers subscribe to, including Wired Montana (wired-mt@wln.com), a listserv for all Montana libraries and those interested in libraries; Ed Info (edinfo@inet.ed.gov), an educational listserv from the U.S. Department of Education (http://www.ed.gov); LM_Net (LM_NET@listserv.syr.edu), a listserv for librarians; and Scout Report (http://wwwscout.cs.wisc.edu/scout/report), a weekly guide to the Internet.

Newsgroups, another type of online forum organized by subject area, are like bulletin boards. People post and read messages at the newsgroup site, rather than having all messages sent to their personal mailbox. Many companies that provide Internet access such as America Online (AOL) and Compuserve offer newsgroups.

Chat rooms allow for real-time communication between users. When you join a chat room, you post messages by typing on the keyboard and the message will appear on other users' monitors. Chat rooms usually have a topical focus, such as sports or support groups. Most online services offer access to chat rooms.

FINDING CURRICULUM

Now that you have the basics, it's time to start using your Net-pertise in the classroom. But where to start? The obvious answer—on the Net. The Net abounds with curriculum materials, lesson plans, and expertise from other teachers eager to share information. But how to find them?

There are two easy ways. One is to start at a Web site known to be education-related. (See the lists in the margins for some sites recommended by educators around the region.) Such a site will provide articles of interest on many topics that educators care about, often including curriculum, lesson plans, and online forums.

NWREL's Library in the Sky (http://www.nwrel.org/sky/), designed for K-12 teachers, parents, and students is one often-recommended starting point. It provides links to educational resources, projects, discussions, collaborations, lessons, curricula, and standards. Another excellent

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resource is a magazine called Classroom Connect—a practical guide to using the Internet in the classroom. "It is one of the best sources of information about Web sites," says Derby. "Each issue highlights sites in subject areas such as art, language arts, science, social studies, math, and so on." Visit the magazine's Web site (http://www.classroom.net) for more details and subscription information.

As you search and browse, dozens of curriculum ideas begin turning up. Now how do you go about incorporating this technology in a thoughtful way? Mainly, by letting the curriculum drive how you use technology in your classroom. Rather than adding interesting projects piecemeal to your repertoire, review your curriculum goals and standards. Then search for projects that will help you achieve them. It's really no different from adding traditional materials to the curriculum.

Here are some important questions to ask during review of a site:

- Does the content support existing curriculum, instructional concepts, or themes?
- Is the site age-appropriate?
- Is the content accurate, current, thorough, relevant, and usable?
- Does the site have identifiable biases?
- Does it present multiple viewpoints?
- Does the site contain any content that might be deemed inappropriate in school?
- In what relevant ways does the content offer experiences that extend learning?

Jane Krauss' fourth- and fifth-grade classroom in Oregon's Eugene School District offers a prime example of letting the curriculum drive the use of the Web. Krauss' students were studying the phases of the moon, but cloudy weather blocked their view of the actual orb. So they turned to Virtual Moon Phase (http://tycho.usno.navy.mil/vphase.html).

Another example: Krauss and colleagues have created a Web site (http://www.4j.lane.edu/WebSites/Harris/Mimi/Voyage_Home.html) that their students used in conjunction with a software curriculum on oceans, Voyage of the Mimi, published by Sunburst. The publisher liked the site so much, Krauss says, it put the site on the Sunburst Web site and gave the school a free copy of the latest curriculum, including an expensive video library.

During yet another unit in which students researched countries around the world, Krauss' kids used films and other traditional research materials along with a set of appropriate Web sites chosen ahead of time by the teacher and "bookmarked" for students' use. They investigated these Web sites to get weather forecasts, learn about current cultural events, and find other information that they then used to write letters home from an imaginary trip to the country.

A "bookmark" is essentially a way to quickly return to a favorite Web site without having to retype the address again and again. After starting the browser (Net software), look at the menu bar (the words such as "file," "edit," and "view" that appear at the top of your screen) for the word "bookmark" or "favorites." Place the mouse cursor on the word, and click. A list of choices will drop down from that word (this list is called a menu). The word "add" should be on the menu. When you find a great Web site you think you'll return to over and over, use the process described above to bookmark the site. In the future, click the mouse on "bookmark" or "favorites" in the toolbar and when the menu drops down, notice that the site has been added to the list. Click again, and the site appears with no further effort.

This bookmarking saves the drudgery of typing in long Web addresses. Bookmarking is also a useful classroom tool. If, like Krauss, you were doing a unit on geography, you could bookmark a set of sites that students could choose from during their research. Using bookmarks to preselect sites can help guide students through the Web maze.

In Alaska's Fairbanks School District, teachers maintain and share extensive bookmark lists in subject-specific areas. A comprehensive list of teacher-selected sites indexed by curriculum areas is maintained for use by anyone visiting the district's Web site

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Skip Via, technology specialist for Alaska's Fairbanks School District, says, "One way we use the Web as a medium for publishing student work. We have had instances of students receiving unsolicited scholarship offers based on their published work. We have had student work selected for publication in the mainstream press (including some books). And we have had well-known authors contact our students about their writing. This has given students a broad audience for their work. Some of their efforts have won international recognition in contests."

Via recommends the following sites:

- The Internet Public Library (http://www.ipl.org/): Educational Hotlists (http://sin.fi.edu/ffi/hotlists/hotlists.html), a collection of online reference works at http://www.cs.cmu.edu/references.html; StudyWeb at http://www.studyweb.com/; and Ask an Expert! (http://njnie.dl.stevens-tech.edu/curriculum/aska.html)
- For learning to use the Net and computers in the classroom, Via recommends the district's own help desk site at http://www.northstar.k12.ak.us/help/desk.html
- For curriculum, he recommends the district's Web site at http://www.northstar.k12.ak.us/web/local/local.html
- Via's list of worthwhile mailing lists and listservs includes http://www.education-world.com; http://www.tie.net/tile/listserv/index.html; http://www.edoc.com/ejournal/; http://www.ipl.org/; http://educom.edu/web/pubs/edreview.html; http://www.chaos.com.80/netteach/index.html; http://ole.net/ole; http://fromnowon.org; http://www.syllabus.com; http://www.nap.edu/readingroom/books/techgap/index.html

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The Library in the Sky

THINK OF IT AS AN INFINITELY EXPANDING UNIVERSE OF IDEAS, resources, contacts, and curricula. The Library in the Sky (http://www.nwrel.org/sky), the online resource collection of the Northwest Regional Educational Laboratory, offers a galaxy of educational opportunities to teachers, students, parents, and librarians all over the planet. Open one door, and it will lead to another. Look through one window, and a world of educational opportunities appears—a world that changes weekly as new Web sites and resources are added and "dead links" are removed. Sitting at your computer, you can:

- Become a "virtual seismologist" through Virtual Earthquake, an interactive computer program that introduces you to the techniques of locating and measuring an earthquake
- Visit the CyberLatin Web site to find "tons" of information about ancient history as well as self-correcting quizzes, software programs for reviewing Latin grammar topics, and examples of student work
- Have students explore the evidence for and against the existence of global warming through the Global Warming Project home page
- Find a wealth of lesson plans and teaching activities for school librarians through the LION (Librarians Information Online Network) home page
- Study the University of Southern Mississippi's "*Cinderella* Project," a text and image archive containing a dozen English versions of the fairy tale (and then move on to *Little Red Riding Hood* and *Jack and the Beanstalk*)

This is a just a tiny sampling of the endless educational resources you can tap through the ever-growing virtual library. Launched in 1995, The Library in the Sky contains nearly 6,500 links to other Web sites. If you've visited in the past, you'll find navigating the site much easier and quicker after a major redesign by Web developer Peter Campbell of the Northwest Laboratory.

You can enter the library in two different ways: by keyword search or by your role in education. If you know what you're looking for, you can type in a few key words and search the library's extensive database. If you're a teacher, you can click the "Teacher" button and you will be taken to a page tailored specifically to the needs and interests of teachers. Students, parents, librarians, and community members also have pages tailor-made to meet their needs and interests.

"The great thing about the library is that it does the searching and careful selecting of information for you," Campbell notes. "Try doing a search for 'lesson plans,' for example. The last time I tried, I got 59,178 matches. How do you know which ones are the best? Who has the time to look at 59,178 Web sites? All the resources in the Library have been reviewed and found to be of high quality for our users."

To be included in The Library in the Sky, resources must be useful for teachers, students, parents, librarians, or the community. They must be safe and appropriate for children. They must contain what Campbell calls "real stuff"—actual documents, projects, pictures, lesson plans, discussion groups. And they must be current. Most resources considered for The Library in the Sky have been recommended by an educator, a librarian, or a national reviewer.

If you have suggestions or comments about The Library in the Sky, contact Peter Campbell at (503) 275-0684 or campbelp@nwrel.org.

The Northwest Educational Technology Consortium, operated by the Northwest Laboratory, also maintains a Web site (http://www.netc.org) focusing on several areas of educational technology: integrating technology with teaching and learning; identifying and supporting leaders at the building level; developing and implementing technology plans; and building infrastructure for networking and telecommunications. Additional technology resources and regional information can be accessed through the Technology Center at the Northwest Laboratory (http://www.nwrel.org). From the Laboratory home page, select "Programs and Services" and then "Technology." The Technology Center's resource librarian Amy Derby can respond to reference and information requests. Contact her at derbya@nwrel.org or (503) 275-9565.

BASIC GUIDANCE FOR BEGINNERS who want to bring the worldwide computer network into the classroom is available from the Education Research Service in its 1996 publication *The Internet Roadmap for Educators*. "Exploring the Internet is like embarking on a journey," the book asserts. "To arrive at your destination, you need to know where you're going, how you'll get there, and what to do if you encounter a roadblock."

Promising to take readers where they want to go, the book gives:

- Examples of innovative ways educators and students are using the Internet
- A listing of education-related sites, newsgroups, and mailing lists
- Examples of collaborative, Internet-based classroom projects
- Instructions for using tools such as e-mail, newsgroups, the World Wide Web
- Discussions of copyright issues and safety guidelines
- A glossary of Internet terms

Among sites listed are Roadmap (http://ua1vm.ua.edu/~crispen/roadmap.html), "a popular site that provides a free, 27-lesson Internet training work-

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shop." Another is the Busy Teacher's Web Site (http://www.gatech.edu/lcc/idt/Students/Cole/Proj/K-12/TOC.html), which "serves as a one-stop Internet location for teachers, grouping classroom resources by subject area."

Copies can be ordered for $20 (plus $3.50 for shipping) from: ERS, 2000 Clarendon Boulevard, Arlington, VA 22201. For information, call (703) 243-2100 or send e-mail to ers@access.digex.net.

GET AN UP-CLOSE AND PERSONAL LOOK at the teachers and students involved in the 10-year Apple Classrooms of Tomorrow study in *Teaching with Technology: Creating Student-Centered Classrooms*. Published in 1997 by Teachers College Press, the book gives a detailed account of how teachers' roles, strategies, and attitudes changed over time when their classrooms were saturated with computers and other high-tech equipment. Authors Judith Sandholtz, Cathy Ringstaff, and David Dwyer describe the gradual alteration of technology-rich classrooms from teacher-centered to student-centered. As technology took hold, students began playing a more active role in their own learning. Meanwhile, teachers gave up their position as "sage on the stage" to become coaches or facilitators—the "guide on the side."

The book offers insight into a broad range of changes—many of them unanticipated—that occurred as the project progressed. Kids who were low achievers or social misfits, for example, often blossomed when they had access to technology. Peer tutoring became commonplace. Students often surpassed their teachers in technology savvy to becoming expert resources not only for other students but for their teacher, as well. Assessment strategies moved away from reliance on traditional testing toward more use of performance and portfolio assessments.

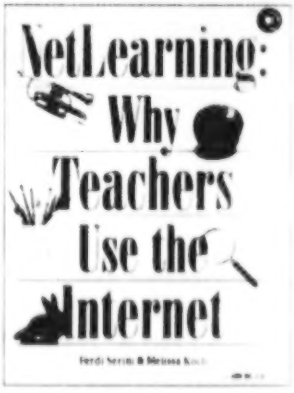
Here's an excerpt from the book: "The benefits of technology integration are best realized when learning is not just the process of transferring facts from one person to another, but when the teacher's goal is to empower students as thinkers and problem solvers. Technology provides an excellent platform—a conceptual environment—where children can collect information in multiple formats and then organize, visualize, link, and discover relationships among facts and events. Students can use the same technologies to communicate their ideas to others, and to add greater levels of understanding to their growing knowledge."

The book is full of anecdotes—real-life stories about the struggles and successes of teachers and their students. It conveys the frustrations and struggles of venturing into new technologies as well as the surprises and triumphs.

You can order the book for $18.95 (plus $2.50 for shipping) from Teachers College Press, P.O. Box 20, Williston, VT 05495-0020. For more information, call 800-575-6566 or visit the Web site at http://www.tc.columbia.edu/~tcpress/.

BRIMMING WITH IDEAS FOR TEACHERS who want to venture onto the information highway is *NetLearning: Why Teachers Use the Internet*, a fat book and accompanying CD-ROM from Songline Studios.

"*NetLearning* is a guide with stories by educators for educators who seek to understand the learning opportunities the Internet provides," write authors Ferdi Serim and Melissa Koch. "This work



addresses the educational benefits of connecting to the Internet, and in doing so, relies upon the real-life experiences of hundreds of Internet pioneers. Each of these people remembers the dues paid in becoming cybercitizens and hopes to reduce the pain of your learning by sharing his knowledge."

Stressing the importance of linking technology to curriculum goals, the book offers detailed descriptions of all sorts of online resources and tools along with firsthand accounts of actual classroom strategies and practices. Among the topics the authors touch on are:

- Planning online exchanges with experts
- The project-based classroom
- Interactive communication tools
- How the Internet supports learning
- Working with agencies such as NASA and the U.S. Geological Survey
- Creating your own projects

The book is packed with addresses of promising Web sites, where teachers can find ideas, hook up with existing projects, or get further training in using new technologies.

Copies can be ordered for $24.95 (plus $4.50 for shipping) from The Book Shelf, EPE, Suite 432, 4301 Connecticut Avenue NW, Washington, DC 20008. For information call 800-346-1834.

***"MY EIGHTH-GRADERS AND I HAVE ONE CLASSROOM COMPUTER**, a pieced-together 286 PC that somehow manages to run Windows on one megabyte of RAM. Hooked up to a 2400 bits-per-second (bps) modem and phone line, it isn't exactly state of the art, but we love it. It works and it gets us out—out the door to a world beyond Pease Middle School and San Antonio, Texas."*

These words from teacher Linda Maston begin a collection of case studies, *Tales from the Electronic Frontier*, compiled and published by the WestEd Eisenhower Regional Consortium for Science and Mathematics Education. The slick, colorful book presents the first-hand accounts of 10 teachers who have used the Internet in K-12 science and math classrooms. Linda Maston's story, "Something in the Air," describes how students' scientific sleuthing led the school district to repair a faulty ventilation system in the school. Glenn Lidbeck's account, "Confessions of a Fourth-Grade Newbie," describes a multischool project to measure the Earth's magnetic field at different locations. Other stories describe student research in the fields of astronomy, meteorology, ecology, and geology, among other explorations. All of the stories are written in a lively narrative format, honestly recounting both the high points and low spots of classroom experiments in networking.

The words and actions of students and teachers come alive in the telling. Here's an example from Karen Nishimoto: "Now I was the one feeling nervous. None of us were Internet experts. I had been using e-mail for four months; most of the students had been using it for one. What if something went wrong? I didn't want students spending all their

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time troubleshooting technological glitches. I was also concerned with how telecommunications would fit in with what we currently do. I want my students to learn how to think scientifically and to conduct scientific investigations. How would using e-mail help them to learn and carry out these processes?"

Throughout the book are sidebars listing Web sites that offer curricula, online projects, and other resources. The book also provides tips on newsgroups, electronic mailing lists, training opportunities, acceptable use, and "shareware" (free software).

Copies can be ordered for $9.50 (plus $4 for shipping) from Tales from the Electronic Frontier, WestEd, 730 Harrison Street, San Francisco, CA 94107. For information call (415) 565-3000.

LOOKING FOR A GOLD MINE OF PRACTICAL TIPS and ideas for integrating new technologies into your curriculum and instruction? A newsletter called *Classroom Connect* might be just what you need. Published nine times a year, the magazine-style newsletter is crammed with lesson plans, Internet resources, success stories, global projects, new-user basics, and dozens of Web sites for teachers, teens, and kids.

The lead story on a recent issue focused on multimedia projects and electronic portfolios. It discussed the relative advantages of software such as HyperStudio, ClarisWorks, HyperCard, The Digital Chisel, and Microsoft PowerPoint. It offered tips for "harvesting" online images, video clips, and sound effects. And it provided addresses for Web sites where readers can see examples of electronic portfolios.

Another recent cover story was about using e-mail to teach writing. Stating that "e-mail can be incorporated into any unit that involves writing," the article discussed "keypals" (online pen pals) and provided addresses for a number of keypal sites where readers can find students to link up with. It also talked about using e-mail as a publishing tool, contacting online authors, and corresponding with students who speak other languages. Also discussed were online mailing lists for young writers.

"*Classroom Connect* is one of the best sources for information about Web sites," says Amy Derby, resource librarian for the Northwest Regional Educational Laboratory's Technology Center.

For a year's subscription, send $39 to: Classroom Connect Inc., P.O. Box 10488, Lancaster, PA 17605-0488. For more information, contact Editor Kathy Housley, 800-638-1639 or mail to: editor@classroom.net. Visit the Web site at http://www.classroom.net.

KIDS DO A LOT OF THEIR COMPUTER WORK AT HOME. To help parents to better understand and monitor their children's online explorations, the U.S. Department of Education has produced a booklet titled *Parents Guide to the Internet*.

Beginning with the very basics (it defines terms such as "mouse" and "modem"), the booklet takes readers through the steps of choosing a computer, getting connected to the Internet, "surfing" (browsing) the World Wide Web, using electronic bookmarks, sending e-mail, joining online mailing lists, and other Internet-related activities.

Of particular interest to parents is the section titled "Tips for Safe Traveling."

"Just as we tell our children to be wary of strangers they meet, we need to tell them to be wary of strangers on the Internet," the booklet stresses. "Most people behave reasonably and decently online, but some are rude, mean, or even criminal."

The booklet advises teaching children that they should:

- Never give out personal information (including their name, home address, phone number, age, race, family income, school name or location, or friends' names) or use a credit card online without a parent's permission.
- Never share their password, even with friends.
- Never arrange a face-to-face meeting with someone they meet online unless a parent approves of the meeting and goes with them to a public place.
- Never respond to messages that make them feel confused or uncomfortable. They should ignore the sender, end the communication, and tell a parent or another trusted adult right away.
- Never use bad language or send mean messages online.

Other sections of the booklet give guidelines for limiting children to appropriate content on the Internet and supporting school use of technology. An Internet site listing categorizes sites as "family-friendly," "megasites," "online reference material," and "sites for parents and parent groups." A glossary defines common terms encountered in online travels.

Single copies of the booklet can be ordered by calling 800-USA-LEARN. You can also find it online at http://www.ed.gov/pubs/parents/internet/.

—Lee Sherman

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GOING SOLO

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questions about stories and literary techniques. (You can view my Sophomore Review Game on the World Wide Web at http://www.ttsd.k12.or.us/schools/ths/jdubois/short_story_review.html.)

If you are blessed with having a multimedia-capable computer, the range of possibilities is endless. I have used movies such as *The Black Stallion* and *The Natural* to teach visual literacy. Students write about and discuss examples of visual literacy observed in the film: zooming for emphasis, juxtaposing scenes to show relationships, foreshadowing to create suspense, lighting to set a mood, camera angle to create an illusion, and so on. When we finish, I give them a visual-literacy test, one in which I have embedded stills from the movie into a ClarisWorks slide show along with enlarged text questions. This extends their understanding, challenges their thinking, and reinforces their awareness of an entirely new way of seeing.

An equally exciting multimedia adventure is making tutorials for prominent characters in Shakespeare's *Julius Caesar*. These instructional slide shows acquaint readers with the characters by presenting information, character motivation, and brief film clips, which students watch before acting out the characters in their reading groups.

Eventually, I became confident enough to require students to include in their term project some aspect of technology—a digital image, a graph, a Web page—that was entirely new to them. Once a week they had class time to work on the project—and yes, we did have access to a computer lab. But we could have scheduled the work throughout the week, giving several students a chance to use the classroom computer each day. Some projects, such as a vocabulary slide show and quiz, became a study resource for other students.

My experiences have taught me that the one-computer classroom truly has the potential to be dynamic, with new possibilities unfolding as time, creativity, and comfort allow. Perhaps most exciting of all is how the computer opens the door to new roles and relationships: student-as-instructor and teacher-as-facilitator.

Jeanine DuBois teaches language arts at Tigard High School, where she avidly promotes technology as an educational tool. In addition to 19 years of teaching English, DuBois has several years' experience teaching workshops for educators through the Northwest Regional Education Service District, Tigard-Tualatin School District, Portland Macintosh Users Group, National High School Association, and NCCE. To visit her educational Web site, point your browser to http://ucuc.ttsd.k12.or.us/schools/ths/jdubois/JD.html. ■

CONQUERING THE COMPUTER

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(http://www.northstar.k12.ak.us)

One final thought about conquering the computer: Have a sense of humor. The day you're ready to use the computer in your classroom for the first time will undoubtedly be the day some horrible glitch will foil your lesson plans. So always have a Plan B that doesn't require the computer. And persevere. As with adopting any new tool, the day will come when you can't imagine how you got along without it.

Resource Note: If you own or have access to an Apple Macintosh—the computer found in most Northwest classrooms—there are two good beginning resources. *The Little Mac Book* by Robin Williams and *Beyond the Little Mac Book* by Robin Williams and Steve Broback. "These little books have big content covering the essentials of operating a Mac," says Derby.

If you own or have access to a personal computer, try reading *PCs for Dummies* by Dan Gookin. The title is strictly humorous. Even though the first chapter covers such basics as how to find the "on" switch, the book never talks down to the reader.

Technical editing for this article was provided by Ann Derby. ■

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Creative ideas for the one-computer classroom

I've become one of those teachers who drools over incorporating technology into my lessons. But I wasn't always that way. Six and a half years ago, I felt overwhelmed. The idea of trying to blend digital pictures, slide shows, interactive telecommunications, and the Internet into my teaching was somewhere between unheard of and downright terrifying. Back then, all I wanted was to type tests on our library's Commodore 64—without having it go haywire before I saved. Since it took 15 minutes to save one document, it was a race against the clock.

A district policy (a very smart policy!) allowing teachers to take a computer home over the summer turned my attitude around. That summer, I signed up for several Macintosh classes through the Math Learning Center at Portland State University. And I played. I made greeting cards with graphics. I created a database for addresses and birthdays. I wrote letters, drew pictures, and even made spreadsheets for keeping track of grades and attendance. This playtime often stretched into the wee hours of the morning.

As I explored and experimented on my Macintosh, I relived the joy of discovery every day. And I formed an opinion: Kids learn computers fastest because they play. Likewise, we teachers need time to play and become comfortable—even excited—about our computers in order to extend their usefulness in classroom instruction.

Over the next few years, my classroom computer use evolved exponentially. At first, the best I could do was to calculate grades, keep attendance, and create handouts and tests with graphics. During that time I learned an important lesson: This contraption was not a mysterious beast that would suddenly self-destruct. What a relief! I just needed time to become secure.

Once I developed some confidence, if only a teensy bit at first, I found that even one computer in a classroom added to my ability to differentiate curriculum, thus challenging my gifted students and assisting my struggling students. I found that a single computer could both enrich instruction and level the playing field, benefitting all my students. A student whose vocabulary was far above the rest of the class, for instance, could use the SAT prep program to stretch herself. A student whose motor coordination made it nearly impossible to write an essay was no longer inhibited by a physical handicap. Through membership in the Portland Macintosh Users Group, I discovered countless programs—many of them public-domain (free) or shareware (inexpensive try-before-you-buy)—that can be used for individualized student instruction. Today, many people discover these resources by surfing the Internet.

Often the classroom computer serves as a tool added to my arsenal of books and other materials. When writing an essay centered around a quotation, for instance, my sophomore language arts students use both *Bartlett's Familiar Quotations* (the book) and *Quotable Quotes* (the Macintosh program). When doing consumer research on a prospective purchase (anything from a pager to a car to a bread machine for Mom or Dad), my junior English students might access *Consumer Reports* magazine online (http://www.consumerreports.org) to find a key issue missing from our collection. Other times a CD-ROM may provide an additional resource. The *Time Almanac*, for example, includes original articles dating back to the early 1900s. A U.S. atlas and a world atlas are also available on CD. The World Wide Web, too, may excite students with the latest discoveries in space or in a university across the world. Sites rich in information useful to students include NASA's Jet Propulsion Lab (http://newproducts.jpl.nasa.gov), the MayaQuest visit to Mayan ruins (http://www.classroom.net/) and the U.S. Holocaust Memorial Museum (http://www.ushmm.org/).

Early on, I discovered that my Macintosh could use a large-screen TV if I connected a $300 presentation device (Presenter Plus Mac/PC Multi-Frequency) between the computer and the television. Initially, this became a way to present textual information—such as vocabulary due dates or lists of ideas generated during a class brainstorming session—in a visual form. The next day, the material could be printed out for absentees, who could retrieve it from the daily absence folders.

The computer/TV duo became a great way to assist visual learners. Whether I presented a chart for organizing data or a brief slide show previewing a lesson, visual students could see where we were going and better fit the ideas into a mental framework. On occasion I even created a literature review game with student-generated

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NORTHWEST EDUCATION

Quarterly magazine of the
Northwest Regional Educational Laboratory

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Co-Editors:
Lee Sherman
Tony Kneidek

Issue Editor:
Lee Sherman

Graphic Production:
Denise Crabtree

Graphic Design:
Dan Stephens

Proofreader:
Catherine Paglin

Contributing Writers:
Denise Jarrett, NWREL Mathematics and Science Education Center; Catherine Paglin; Melissa Steineger

EdPress WINNER
1997 GOLDEN LAMP AWARD

NORTHWEST EDUCATION
can be accessed on
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